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AUSTRALASIAN ANTARCTIC EXPEDITION

1911 - 1914.

UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, D.Sc., B.E.

SCIENTIFIC REPORTS.

SERIES C.—ZOOLOGY AND BOTANY.

VOL III. PART 1.

FISHES

BY

EDGAR R. WAITE, F.L.S.,

DIRECTOR, SOUTH AUSTRALIAN MUSEUM.

With Five Plates, Two Maps, One Chart, and Sixteen Figures in the Text.

PRICE EIGHT SHILLINGS AND SIXPENCE.
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NATIONAL MUSEUM MELBOURNE

AUSTRALASIAN ANTARCTIC EXPEDITION.

SCIENTIFIC REPORTS.

PREFATORY NOTE.

Thanks to the Premier (the Hon. Crawford Vaughan) and the Government of South Australia, acting through the Government Printer (Mr. R. E. E. Rogers), the printing of the Scientific Reports of the Expedition has commenced with this part. Further contributions will appear in succession, approximately in the order in which they are received.

The completed work will be a large one, and several years will elapse before all is published. The plan of publication is to divide the subject-matter into the following main divisions :—

NARRATIVE.

SERIES A.—Geography, Physiology, Glaciology, Oceanography, Geology.

SERIES B.—Meteorology, Journal of Auroræ, Wireless Journal, Tides, Magnetics

SERIES C.—Zoology, Botany.

Each Series will comprise a number of volumes, and each volume one or more parts. The subject-matter has been distributed provisionally among as many volumes as seem likely to be required. No attempt will be made to complete a volume before commencing the publication of its successor.

Professor W. A. Haswell, who organised the programme of the Biological Section of the Expedition, has already made arrangements for the working out of most of the Groups collected. Fortunately, also, Professor Haswell has undertaken the work of supervising and editing Series C of these reports.

DOUGLAS MAWSON.

UNIVERSITY, ADELAIDE.

EDITORIAL PREFACE TO THE "C" SERIES OF REPORTS.

In accordance with Dr. Mawson's request, conveyed by wireless from Adelie Land, I undertook, in May, 1913, the superintendence of the biological collections of the Expedition and the task of arranging for the working out of the results. The greater part of the collections came to hand at the end of the same month, and, in order that they might be sorted into groups, were placed in charge of Mr. John G. Hunter, B.Sc., who had been with the Expedition at the main base as Biologist, had collected a large proportion of the material obtained there, and had supervised the deep-sea trawling work of the "Aurora" in antarctic seas. A year later, in July, 1914, the collections of Invertebrata made by Mr. Harold Hamilton, at Macquarie Island, were received. The two sub-antarctic cruises of the "Aurora," with Mr. Edgar R. Waite as Biologist of the first, and Prof. T. T. Flynn of the second, also contributed to the sum total of the collections to be disposed of.

The negotiations for the distribution of the various groups of animals and plants comprised in the collections were favoured by the visit paid to Australia in 1914 by a number of leading biologists on the occasion of the meeting of the British Association, and, with some disappointments, led, on the whole, to very gratifying results. It had been the wish of Dr. Mawson and of the Antarctic Committee that—the Expedition being essentially an Australasian undertaking—the working out of the results should be entrusted as much as possible to Australasian investigators. This has been kept in mind throughout in disposing of the biological collections; but there were a number of groups in which the assistance of specialists outside Australia and New Zealand was essential for adequate treatment, and to those biologists in Britain and elsewhere who have generously consented to report on such groups—often large and important—the Expedition is under a great obligation.

To Mr. R. Etheridge, Curator of the Australian Museum, and his Staff, I have been indebted for much valuable assistance, especially in connection with the custody, conservation, and distribution of the larger specimens.

W. A. HASWELL.

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CONTENTS.

	PAGE.
GENERAL—	
Literature	5
Stomach Contents	5
Parasites	6
Illustrations	6
Division of Southern Areas, with Chart	7
Fishes of the Glacial Ooze	9
SYSTEMATIC—	
1. Antarctica	10
2. Macquarie Island and the Subantarctic	45
3. Australasia	74
4. Addendum	81
EXPLANATION OF PLATES, ETC.	83
INDEX	85
PLATES	I.–V.
MAPS	I., II.

MUSEUM MELBOURNE

THE FISHES.

By Edgar R. Waite, F.L.S., Director South Australian Museum.

[*Contribution from the South Australian and Canterbury Museums**].

(Plates I.-V., Text Figures 1-16, and Maps I., II.)

LITERATURE.

Writers on Antarctic fishes have usually supplied a bibliography of the subject in the several works which have been published. The latest, entered below, is by Mr. C. Tate Regan, and he therein enumerates the principal memoirs dealing with Antarctic and Subantarctic fishes. This and one additional reference may be thus recorded.

1914.—Hussakof, L. Notes on a small collection of fishes from Patagonia and Tierra del Fuego, Bull. Amer. Mus. Nat. Hist. xxxiii., pp. 85-94 (Feb. 13).

† 1914.—Regan, C. T. Fishes of the British Antarctic (" Terra Nova ") Expedition, 1910, pp. 1-54, pls. i.-xiii. (June 27).

The descriptions of most of the species enumerated in the following pages were prepared before the paper by Prof. Roule on the Fishes of the Deuxieme Expédition antarctique Française (" Pourquoi Pas ? ") and that of Mr. Regan, cited above, reached Australia, a circumstance which will explain the appearance of certain re-descriptions.

STOMACH CONTENTS.

The general stomach contents of the fishes dealt with were forwarded to Prof. Haswell, of Sydney, and he, in conjunction with Mr. Thomas Whitelegge, identified such material as was in suitable condition; the more or less digested crustaceans were submitted to Dr. Chilton, of Christchurch, while remains of annelids, etc., were similarly sent to Prof. Benham, of Dunedin, but I anticipate that little can be said of the invertebrates, which were for the most part in unsatisfactory condition; notes already

* Portion of the paper was prepared by the author during the time he was Curator of the Canterbury Museum, Christchurch, New Zealand.

† See Addendum, p. 81.

supplied to me are included under the fishes concerned. Some of the fish remains recovered from the stomachs were in a state permitting identification, and these likewise are recorded.

PARASITES.

The fishes of the genus *Notothenia* are unfavorably known to all who have visited our Subantarctic lands on account of the parasites which infest the flesh, while revulsion is occasioned to some by the mere sight or handling of the fish, due to presence of external parasites.

During the course of a visit paid to the Antipodes Islands in February, 1907, many specimens of *N. colbecki* were caught with hand lines from the steamer, and of these I wrote—"Some of them had fluke-like parasites which glided over their scales, while the muscles were infested with white round worms, so that none of the party was anxious to sample the edible properties of their catches." Of *N. microlepidota* the late Captain Hutton* wrote—"Most of the fish at the Auckland Islands are attacked by parasites in a most remarkable way; in some cases the whole of the lateral muscles being full of a round worm about an inch in length. So bad are they that nothing but sheer necessity would induce anyone to eat fish at these islands."

Mr. Ainsworth has feelingly described the presence of parasitic worms in *N. macrocephala* at Macquarie Island, and as the party were at one period very short of food, there was little choice but to eat fish, infested though it was. Mr. Ainsworth's words are quoted on page 69 of this paper. The scientific account of the parasites will appear in the special report devoted to this subject.

ILLUSTRATIONS.

While I have prepared the drawings from which the plates are reproduced, my assistant, Mr. Herbert M. Hale, made the line drawings which appear in the text and on Plate V. The blocks were made by Messrs. Porter & Barnett, of Adelaide. To them and to the Government Printer (Mr. R. E. E. Rogers) my thanks are tendered for the careful manner in which the reproductions have been made.

Mr. P. E. Correll, one of the photographers with the expedition in Antarctica, took a number of colour photographs of fishes, but they cannot unfortunately be utilised in this paper. Sir Douglas Mawson hopes to reproduce some of them in the Zoological logs of the expedition.

A coloured plate of fishes appeared in the "Home of the Blizzard," and photographs of the three species therein reproduced are identified in the present paper as portraying *Doloidraco longedorsalis*, *Aconichthys harrissoni*, and *Dacodraco hunteri*.

* Hutton, Trans. N.Z. Inst., xi., 1879, p. 340.

DIVISION OF SOUTHERN AREAS.

In 1912 the late Sir Clements R. Markham * proposed to divide the Antarctic Region into four Quadrants, each having the Pole as its apex and the Antarctic Circle as its arc. They were thus defined and named :—

90° E. to 180°—The Victoria Quadrant.

180° to 90° W.—The Ross Quadrant.

90° W. to 0°—The Weddell Quadrant.

0° to 90° E.—The Enderby Quadrant.

In 1914 Mr. C. Tate Regan † delimited the Southern Area into three Zones, namely, the South Temperate Zone, comprising the latitude up to the mean annual surface isotherm of 12° C. ; the Subantarctic Zone to the isotherm of 6° C. ; and the Antarctic Zone. He further divided each Zone into Districts, namely, the Glacial District marking the limit of pack ice, the Kerguelen, Magellan, and Antipodes Districts named according to the position of the main land masses.

These three latter Districts roughly correspond to the areas outside the respective Quadrants as defined by Markham ; but dealing with land masses only, they do not include the whole of the areas herein sought to be embraced.

As it may be convenient, therefore, to designate these extended Quadrants they may be named as follows :—

Australian Zonal Quadrant—An extension of the Victoria Quadrant.

Pacific Zonal Quadrant—An extension of the Ross Quadrant.

American Zonal Quadrant—An extension of the Weddell Quadrant.

African Zonal Quadrant—An extension of the Enderby Quadrant.

The accompanying chart shows the respective areas of the Antarctic and Extended Quadrants together with the Zones and Districts above enumerated.

* Markham, Geogr. Journ. xxxix., 1912, p. 575 and chart.

† Regan, Brit. Antarct. Exped. ("Terra Nova"), 1910, i. 1914, p. 25 and chart.

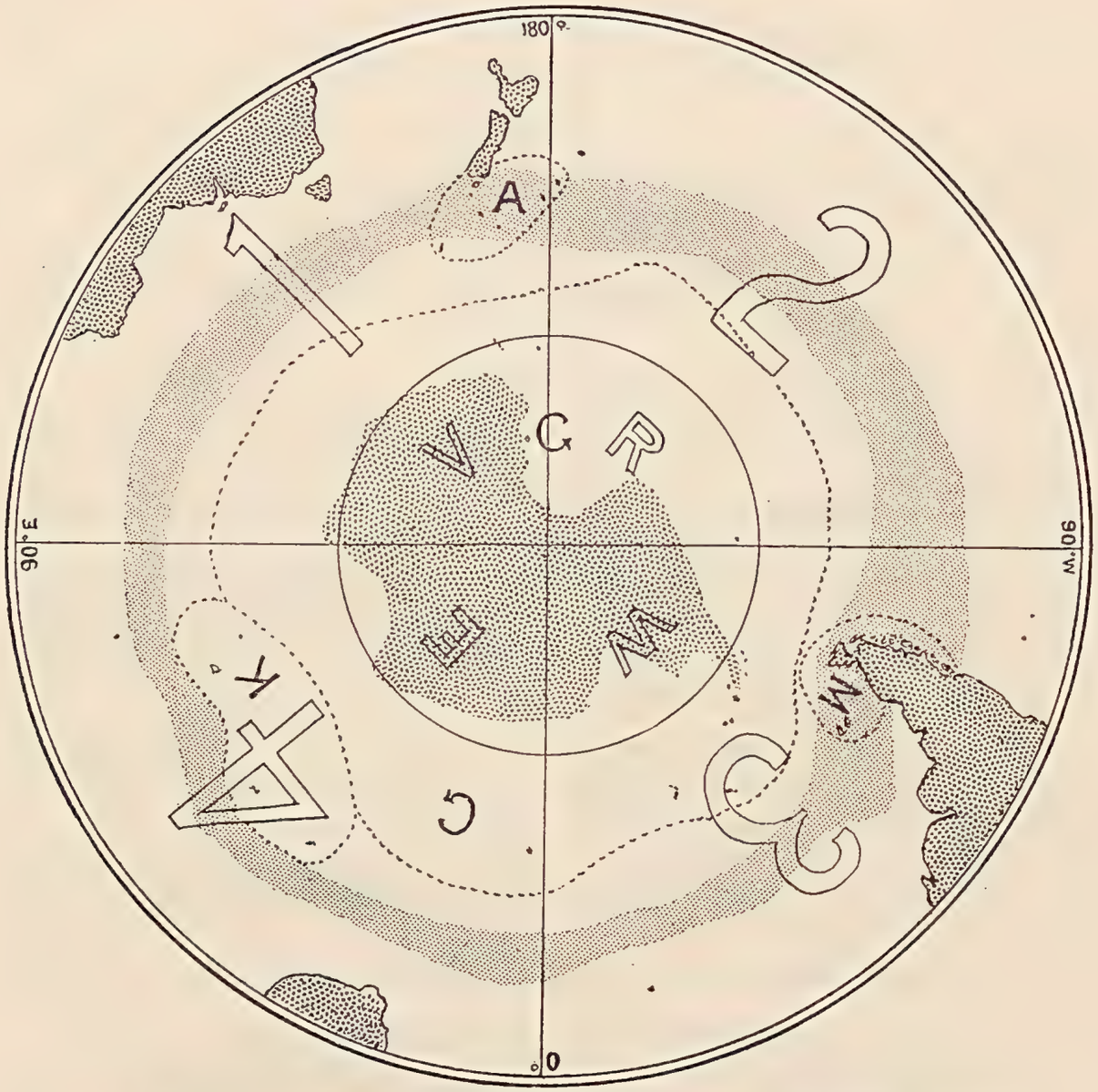

CHART OF ANTARCTIC, SUBANTARCTIC, AND SOUTH TEMPERATE REGIONS.

(Adapted from those published by Sir Clements R. Markham and Mr. C. Tate Regan.)

QUADRANTS	V. Victoria Quadrant.	1. Australian Zonal Quadrant.
	R. Ross Quadrant.	2. Pacific Zonal Quadrant.
	W. Weddell Quadrant.	3. American Zonal Quadrant.
	E. Enderby Quadrant.	4. African Zonal Quadrant.
ZONES	Outer white area.—South Temperate Zone.	
	Shaded area.—Subantarctic Zone.	
	Inner white area.—Antarctic Zone.	
DISTRICTS	A. Antipodes District.	
	M. Magellan District.	
	K. Kerguelen District.	
	G. Glacial District.	
LAND MASSES ..	In heavy shading.	

FISHES OF THE GLACIAL OOZE.

Anyone familiar with glaciers eroding land surfaces will be aware of the enormous amount of fine sticky mud that occurs in the ice, especially noticeable in the terminal faces, where the ice is frequently so obscured with mud that the axe alone reveals its true nature. In glaciers of low latitude, as in those of New Zealand, the mud is discharged into the water resulting from the melting ice, and the stream flowing from the glacier is characteristically muddy. Where a glacier flows directly into the sea the contained mud is deposited from its under surface and terminal face, and, in the absence of strong currents, would be confined to the area beneath the floating ice; as however, considerable movement of the water takes place, the finer mud is carried to considerable distances.

A glance at the following list of dredging and trawling stations will show that out of 13 effective stations where the nature of the bottom is indicated, nine recorded ooze. With the exception of the hauls made at the Main Base in Commonwealth Bay, all appear to have been made within the sphere of influence of glacial mud, and this was apparently so certainly looked for in the dredge that at Stations VII. and XII. the words "No ooze" appear in the list supplied by the collectors.

The records are insufficient to enable one to draw very definite conclusions as to the habitat of the fishes obtained, but we may notice that correlated with the absence of ooze, we miss the soft-bodied *Paraliparis* and the eel-like *Austrolycichthys* and *Lycodichthys*, which, progressing by sinuous motions through the mud, have, in common with some eels and other fishes of similar habit, suffered a diminution in their fins. The ventrals, or pelvics, appear to be lost first, and those of the two genera mentioned are reduced almost to vanishing point. Progression being performed mainly by the motions of the hinder portion of the body the functions of the tail have been largely increased by a coalescence of the dorsal and anal rays with those of the caudal, so that a powerful swimming organ has thereby resulted.

The two species of *Chalinura*, taken at Stations V. and VI., were obtained off the exposed edge of the pack ice, in very deep water, among rocks apparently jutting up through the ooze. Apart from those mentioned all the constituents of the Antarctic collection are Notothenioid fishes, and were taken both among ooze and on rocky bottom; the largest haul, as regards number of species, was made at Station VII., where 11 different species were taken; "no ooze."

The fishes taken on the expedition, or rather series of expeditions, may be considered under three geographical headings, namely:—

1. Antarctica.
2. Macquarie Island and the Subantarctic.
3. Australasia.

1. ANTARCTICA.

Fishes were taken by means of traps at the Main Base, Adelie Land, under Sir Douglas Mawson, by Mr. J. G. Hunter and Dr. A. L. McLean; and at the Western Base, Queen Mary Land, under Mr. Frank Wild, by the late Mr. C. T. Harrisson. During the summer cruise of 1913-14, good use was made of the Agassiz trawl, and 12 stations were plotted, in the neighbourhood of the sea ice, as shown on the accompanying map. A few fishes also were obtained by means of tow nets, and others were taken from the stomachs of seals and fishes. The following is a complete list of the fishes taken by the expedition in Antarctica :—

Atopichthys sp.
Chalinura ferrieri Regan
Chalinura whitsoni Regan
Lycodichthys antarcticus Pappenheim
Austrolycichthys brachycephalus Pappenheim
Trematomus newnesi Boulenger
Trematomus nicolai Boulenger
Trematomus bernacchii Boulenger
Trematomus hansoni Boulenger
Trematomus loennbergii Regan
Trematomus pennellii Regan
Trematomus centronotus Regan
Trematomus scotti Boulenger
Trematomus eulepidotus Regan
Pleuragramma antarcticum Boulenger
Notothenia coriiceps Richardson
Artedidraco shackletoni Waite
Dolloidraco longedorsalis Roule
Pogonophryne scotti Regan
Bathydraco nudiceps sp. nov.
Gerlachea australis Dollo
Aconichthys harrissoni gen. et sp. nov.
Cygnodraco mawsoni gen. et sp. nov.
Prionodraco evansii Regan
Dacodraco hunteri gen. et sp. nov.
Pagetopsis macropterus Boulenger
Cryodraco antarcticus Dollo
Chionodraco kathleenae Regan
Paraliparis wildi sp. nov.

DETAILS OF THE SEVERAL STATIONS TOGETHER WITH THE FISHES TAKEN THEREAT.

Station.	Date.	Position.	Depths in Fathoms.	Temp. C.	Bottom.	Fishes.
Main Base	1912–14	Commonwealth Bay, Adelie Land. Lat. 67° S., Long. 142° 36′ E.	2½–5	—	Rocky, with red and brown algæ attached to rocks. (Dredges and fish traps)	*Trematomus bernacchii* *Notothenia coriiceps*
Western Base...	1912–13	Off Shackleton Ice-shelf, Queen Mary Land. Lat. 66° 18′ S., Long. 94° 58′ E.	210–270	—	Ooze (Fish trap)	*Lycodichthys antarcticus* *Austrolycichthys brachycephalus* *Trematomus loennbergii* *Prionodraco evansii*
I.	Dec. 22, 1913	Commonwealth Bay, Adelie Land. Lat. 66° 50′ S., Long. 142° 6′ E.	350–400	—1·85°	Ooze	*Trematomus bernacchii* *Trematomus centronotus*
II.	Dec. 28, 1913	Lat. 66° 55′ S., Long. 145° 21′ E.	288–300	—1·8°	Ooze, with diatoms	*Trematomus loennbergii*
III.	Dec. 31, 1913	Lat. 66° 32′ S., Long. 141° 39′ E.	157	—1·62°	Ooze	*Trematomus bernacchii* *Pagetopsis macropterus*
IV.	Jan. 2, 1914	Lat. 65° 48′ S., Long. 137° 32′ E.	230	—1·4°	Ooze	No fishes
V.....	Jan. 6, 1914	Lat. 64° 34′ S., Long. 127° 17′ E.	1,700	—0·3°	Thick ooze and rocks	*Chalinura ferrieri*
VI.	Jan. 14, 1914	Lat. 63° 13½′ S. Long. 101° 42′ E.	870	—0·2°	Ooze and rocks	*Chalinura whitsoni*
VII.	Jan. 21, 1914	Off Drygalski Island. Lat. 65° 42′ S., Long. 92° 10′ E.	60	—	Red algæ, few small rocks, no ooze	*Trematomus newnesi* *Trematomus bernacchii* *Trematomus pennellii* *Trematomus scotti* *Trematomus eulepidotus* *Artedidraco shackletoni* *Pogonophryne scotti* *Cygnodraco mawsoni* *Prionodraco evansii* *Cryodraco antarcticus* *Chionodraco kathleenæ*

DETAILS OF THE SEVERAL STATIONS TOGETHER WITH THE FISHES TAKEN THEREAT—*continued.*

Station.	Date.	Position.	Depths in Fathoms.	Temp. C.	Bottom.	Fishes.
VII.A	Jan. 22, 1914	Lat. 66° 28½′ S., Long. 92° 42′ E.	350	—	(Fish trap)	*Trematomus hansoni* *Trematomus loennbergii*
VIII.	Jan. 27, 1914	Lat. 66° 8′ S., Long. 94° 17′ E.	10	—	(Tow net)	*Pleuragramma antarcticum*
IX.	Jan. 28, 1914	Off Shackleton Ice-shelf. Lat. 65° 20′ S., Long. 95° 27′ E.	240	−1·38°	Ooze	*Trematomus loennbergii* *Trematomus scotti* *Bathydraco nudiceps* *Aconichthys harrissoni* *Prionodraco evansii*
X.	Jan. 29, 1914	Off Shackleton Ice-shelf. Lat. 65° 6′ S., Long. 96° 13′ E.	325	−1·65°	Ooze	*Austrolycichthys brachycephalus* *Trematomus loennbergii* *Dolloidraco longedorsalis* *Bathydraco nudiceps* *Aconichthys harrissoni* *Chionodraco kathleenæ* *Paraliparis wildi*
X.A	Jan. 30, 1914	Lat. 65° 0′ S., Long. 96° 5′ E.	350	—	(Fish trap)	*Trematomus loennbergii*
XI.	Jan. 31, 1914	Off Shackleton Ice-shelf. Lat. 64° 44′ S., Long. 97° 28′ E.	358	—	Ooze	*Trematomus nicolai* *Trematomus scotti* *Dolloidraco longedorsalis* *Gerlachea australis* *Dacodraco hunteri* *Pagetopsis macropterus*
XII.....	Jan. 31, 1914	Off Shackleton Ice-shelf. Lat. 64° 32′ S., Long. 97° 20′ E.	110	—	Small rocks, no ooze, animal life abundant	*Trematomus centronotus* *Trematomus scotti* *Trematomus eulepidotus* *Aconichthys harrissoni*

ATOPICHTHYS Garman, 1899.

Atopichthys *sp.*

A larval fish, apparently an eel, 9·5mm. in length, was obtained on January 21st, 1914, at a depth of 20 fathoms, off Drygalski Island.

Family MACROURIDÆ.

CHALINURA Goode and Bean, 1883.

Chalinura ferrieri *Regan.*

Chalinura ferrieri Regan, Trans. Roy. Soc. Edin. xlix., 1913, p. 236, pl. ii., fig. 1.

(Text fig. 1.)

A single example taken at Station V., Lat. 64° 34′ S., Long. 127° 17′ E., at 1,700 fathoms, the temperature being —0·3 C.

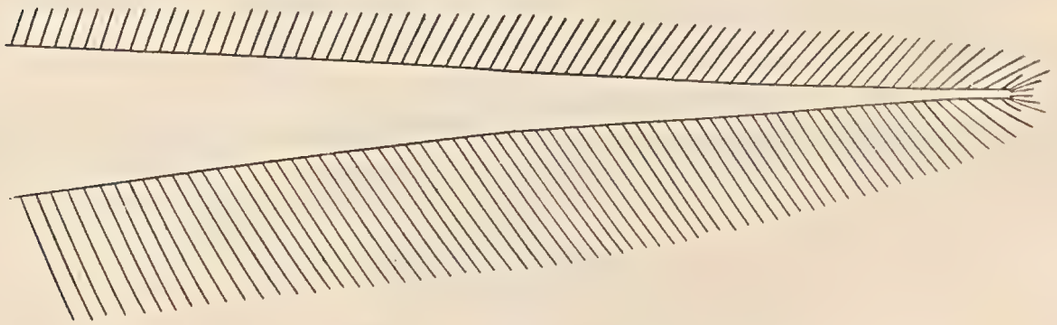

Fig. 1.—*Chalinura ferrieri.*

Hinder part of body. Natural size.

This is evidently a deep water form, the type having been taken in 1,410 fathoms. Our specimen measures 250mm. in length, and is, therefore, slightly larger than the type. It agrees quite well with the description, but the phrase " Dorsal ii. 9 ; distance from second dorsal a little more than three-quarters the length of head " is rather misleading ; the measurement was evidently taken from the origin of the first dorsal, the intradorsal space being half the length of the head, as in our specimen and as in Mr. Regan's figure. It is also evident that the rays on the hinder part of the body of the type were much abraded, for there is little or no diminution of their length as figured ; they are at least 8mm. long, possibly at the end of the tail also, which has been slightly damaged. The accompanying figure shows the condition existing in our specimen.

Chalinura whitsoni *Regan.*

Chalinura whitsoni Regan, Trans. Roy. Soc. Edin., xlix., 1913, p. 236, pl. ii., fig. 2.

Two specimens taken at Station VI., Lat. 63° 13′ S., Long. 101° 42′ E. the depth being 870 fathoms and the temperature —0·2 C.

The larger example measures 525mm. and the smaller 332mm. in total length; the former differs from the smaller example and from the type in having the intradorsal space equal to one-third the length of the head, otherwise no differences are detected. The two specimens were measured by Mr. J. G. Hunter on board the "Aurora," and his figures are here appended:—

	A		B
Total length	572	..	337
Length of head	115	..	71
Depth of body	103	..	55
Interorbital space	29	..	16
Diameter of eye	36	..	23
Length of snout	31	..	21
Snout to origin of dorsal	134	..	80
Colour of eyes	Golden	..	Golden
Weight	31oz.	..	19½oz.

Stomach Contents.—The stomach contained two prawns, apparently of the genus *Penæus*.

Family ZOARCIDÆ.

LYCODICHTHYS Pappenheim, 1911.

Lycodichthys antarcticus *Pappenheim.*

Lycodichthys antarcticus Pappenheim, Sitzungsb. Ges. naturf. Freunde Berlin, viii., 1911, p. 383, and Deutsche Südpolar Exped. 1901-3, xiii. Fische 1912, p. 180, pl. ix., fig. 6; pl. x., fig. 4.

A fine series of this species was obtained of various sizes, the largest being 190mm. in length. The marbled colouration is well shown in Pappenheim's figure (ix. fig. 6).

All the specimens were collected by Mr. Harrisson at the Western Base, Queen Mary Land, Lat. 66° 18′ S., Long. 94° 58′ E., by means of traps, in 270 fathoms, on a bottom of ooze, the formation of which is referred to under the note on page 9.

Stomach Contents.—The stomachs and intestines of these fishes were crowded with the remains of Amphipods which Prof. Haswell identifies as species of *Amaryllis*.

The types taken by the "Gauss" Expedition were obtained at Kaiser Wilhelm Land, which adjoins Queen Mary Land, the conditions of which are probably similar, judging from the similarity of its fish fauna, the following species are known to be common to the two localities:—

Pleuragramma antarcticum.
Pagetopsis macropterus.
Cryodraco antarcticus.
Lycodichthys antarcticus.
Austrolycichthys brachycephalus.

AUSTROLYCICHTHYS Regan, 1913.

Austrolycichthys brachycephalus *Pappenheim.*

Lycodes brachycephalus Pappenheim, Deutsche Südpolar Exped. 1901-3, xiii., Fische 1912, p. 179, pl. x., fig. 3.

Austrolycichthys brachycephalus Regan, Trans. Roy. Soc. Edin. xlix. 1913, p. 244, fig. 2.

(Plate I., fig. 1, and Text figs. 2 and 2a.)

B. vi.; D. 90; A. 70; V. i.; P. 16; C. 10; Vert. 29 + 68 = 97.

Length of head, 6·4; depth of body, 7·1 in the length; diameter of eye, 5·4; of orbit, 3·3; length of snout, 3·4; and interorbital space, 2·9 in the head.

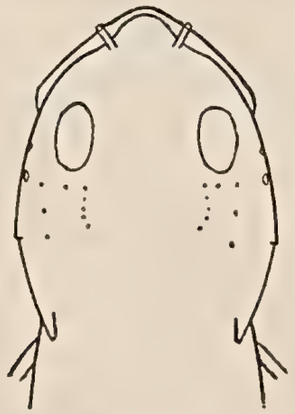

Fig. 2.—*Austrolycichthys brachycephalus.*

Upper view of head. Natural size.

Head subcircular, as deep as broad, flattened below; eye sublateral in the anterior half of the head; the nostril lies in a long tube, nearer to the lips than to the eye; mouth large, subterminal, the upper jaw the longer, the lips are reflexed, the lower ones especially; they do not cross the symphysis but form a long lobe-like projection on

each side; the maxilla extends to below the anterior third of the eye; gill-opening an oblique slit in front of, and of equal depth with, the base of the pectoral; gills four; the gill-rakers are in the form of small hooks, 12 in number on the first arch; body rounded in front and extremely compressed behind.

Teeth.—The teeth are short and stout and of uniform character throughout; those in the upper jaw form three series, the anterior of which consists of two teeth, placed close together; the second series forms an arch not extending backwards to the angle of the mouth; the third series is short and formed of two lines which do not quite meet; the lower teeth are triserial in front and uniserial at the sides; the vomerine teeth form a triangle with the apex forward, they are seven in number and set in three

Fig. 2A.—*Austrolycichthys brachycephalus.*
Arrangement of teeth. Natural size.

rows, containing one, two, and four teeth respectively; the palatine teeth are arranged in two rows, an outer series extending as far as the middle of the eye and a smaller inner series confined to the anterior portion of the palatine bones. The complete condition is illustrated in the figure, no teeth on the tongue, the pharangeal teeth form oval patches, two in the upper and one in the lower jaw.

Fins.—The dorsal originates at a point behind the snout, one-fourth the total length, and the anal arises a little nearer the head than the end of the tail; both fins are low and confluent with the caudal; the longest rays are about twice the diameter of the eye. The pectoral is rounded and comparatively large, being two-thirds as long as the head. The ventrals lie in advance of the base of the pectorals; the distance between them equals the diameter of the eye; they are very short—two-thirds of an eye-diameter in length.

Scales and Pores.—Apart from the head, the space in front of the dorsal fin, and a narrow strip in the middle of the belly, the body is covered with closely set minute scales, which appear as light-coloured dots on the skin. The pores are confined to the head, where they form two series—one widely bordering the lower half of the eye and the other extending along the lower jaw backwards and along the border of the preopercle;

five minute pores form a line behind the upper part of the eye, and a short line of five imperforate scales above the pectoral take the position normally occupied by a lateral line. There are a few other pores on the head, but they are extremely minute.

Colours.—The general hue is brown, with minute and closely set white spots due to the presence of imbedded scales; lips, space round the eyes, outer half of the vertical fins, and the ventrals white; lining of body cavity black.

Stomach Contents.—Crustaceans. Identified by Prof. Haswell as Amphipods, probably of the genus *Amaryllis*.

Reproduction.—The females are full of spawn; the ova, apparently ripe, being of large size, 5mm. in diameter, and of ruby colour.

Length.—267mm.

Locality, etc.—The specimen described was taken at Station X., Lat. 65° 6′ S., Long. 96° 13′ E., off Shackleton Ice-shelf, at a depth of 320 fathoms, the temperature being —1·65 C. A single specimen only of this species was taken at this station, but others were secured off the Western Base (Lat. 66° 18′ S., Long. 94° 58′ E.) by means of fish traps, the depth being 270 fathoms.

Remarks.—The specimens vary considerably in size. The smallest exhibit very striking markings, the whole upper surface from the snout to the end of the tail being dark purplish brown sharply defined from the lower parts, which are of cream colour; the line of demarcation cuts the middle of the eye, but the dark hue surrounds the orbit; the body along the base of the anal fin is likewise of dark colour, which unites with the dorsal band on the caudal, leaving the tip of the latter white; the edges of the vertical fins are white as in the adult.

The dorsal and anal fins in our specimens, as ascertained by dissection, originate further back than in those previously figured. A more forward insertion is a character of younger examples.

Note.—The only specimens of the species previously known were the originals taken by the German South Polar Expedition at the winter quarters of the "Gauss" in 385 metres (= 210 fathoms). Kaiser Wilhelm Land and Queen Mary Land adjoin, and as the Australasian Expedition's examples were obtained in Davis Sea, the two localities are comparatively near to each other, though our specimens were taken in deeper water.

Family NOTOTHENIIDÆ.

TREMATOMUS Boulenger, 1902.

Trematomus newnesi *Boulenger.*

Trematomus newnesi Boulenger, Rep. "Southern Cross" Pisces, 1902, p. 177, pl. xi.
Regan, Trans. Roy. Soc. Edin. xlix. 1913, p. 259.

Notothenia cyancobrancha Vaillant, Expéd. Antarct. Française, Poiss. 1906, p. 26.

Notothenia microlepidota Vaillant, *loc. cit.*, p. 35.

Notothenia hodgsoni Boulenger, Nat. Antarct. Exped. ii. Fish, 1907, p. 2, pl. i., fig. 2.

One specimen, 185mm. in length, was obtained at Station VII., Lat. 65° 42′ S., Long. 92° 10′ E., off Drygalski Island, in 60 fathoms; and the remains of a second specimen, apparently of this species, were removed from the stomach of a Weddell Seal off Adelie Land, November 3rd, 1912.

Trematomus nicolai *Boulenger.*

Notothenia nicolai Boulenger, Rep. "Southern Cross" Pisces, 1902, p. 184, pl. xv.
Roule, Deux. Expéd. Antarct. Française Poiss. 1913, p. 5.

Trematomus nicolai Regan, Trans. Roy. Soc. Edin. xlix., 1913, p. 260.

Two small specimens, associated with this species, were taken at Station XI., Lat. 64° 44′ S., Long. 97° 28′ E., off Shackleton Ice-shelf, in 358 fathoms. The naked upper surface of the head and scaly cheeks and opercles, together with the narrow interorbital space, are characters of this species. The specimens agree with Roule's example from Peterman Island in having five spines in the dorsal fin, but otherwise do not appear to differ from the type, excepting, perhaps, in the absence of tubules in the lower lateral line. The specimens are evidently young and are somewhat abraded. Attention is drawn to the fact that they were obtained at great relative depth; the types were taken in 4 to 8 fathoms in the neighbourhood of Cape Adair, while that caught by the "Pourquoi-pas?" was secured at a depth of 1 metre only, and, as above mentioned, the examples now recorded were taken in 358 fathoms. The specimens are equal in size and measure 115mm. in total length.

This species bids well to be of circumpolar distribution, being known from the Weddell Quadrant and the two extremes of the Victoria Quadrant, within the Antarctic Zone.

Trematomus bernacchii *Boulenger.*

Trematomus bernacchii Boulenger, Rep. "Southern Cross," Pisces, 1902, p. 181, pl. xiv. Regan, Trans. Roy. Soc. Edin. xlix., 1913, p. 262.

Notothenia elegans Vaillant, Expéd. Antarct. Française, Poiss, 1906, p. 28.

Eighteen specimens were preserved, taken as follows:—One at Station I., Lat. 66° 50′ S., Long. 142° 6′ E., in Commonwealth Bay, at a depth of 354 to 400 fathoms, the temperature being —1·85 C.; one at Station III., Lat. 66° 32′ S., Long. 141° 39′ E., near Commonwealth Bay, in 157 fathoms, at a temperature of —1·62 C.; four at the Main Base, Lat. 67° 0′ S., Long. 142° 36′ E., taken in Commonwealth Bay by means of the fish trap, at a depth of 2½ to 5 fathoms; and 12 at Station VII., Lat. 65° 42′ S., Long. 92° 10′ E., off Drygalski Island, in 60 fathoms.

The genus *Trematomus* was diagnosed by Boulenger as distinct from *Notothenia* on the position of the scapular foramen; in the latter it lies between the scapular and the coracoid, while in *Trematomus* it constitutes a perforation in the former bone. The value of this character was challenged by Pappenheim, who illustrated considerable variations in different species, and also believed that while some examples of *Notothenia lepidorhinus* Papp. conform to the scapular requirements of the genus, others have the foramen pierced as in *Trematomus*. He concludes that while the perforation of the scapular may hold good for *Trematomus*, the scapular coracoid foramen is invalid as a definite character for *Notothenia*. There is much to be said against the employment of such characters for diagnostic purposes, but it cannot be argued that any other really satisfactory determinative character has so far been offered in substitution. The value of Pappenheim's deductions was largely discounted by Regan's supposition that the specimen with the perforate hypercoracoid was not *Notothenia lepidorhinus* but really *Trematomus hansoni*. More recently Regan transferred the former species, that upon which Pappenheim made the observations above recorded, to *Trematomus*, apparently admitting the validity of the species but presuming faulty dissection. The latter author placed the species originally described as *Trematomus hansoni* and *T. bernacchii* under *Notothenia*, but Regan reinstated them, and if the character of the scapular fenestra is to be allowed as valid for *Trematomus* there is no question as to the inclusion of these two species, the condition being verified by examination of material now in hand.

Trematomus hansoni *Boulenger.*

Trematomus hansoni Boulenger, Rep. "Southern Cross," Pisces, 1902, p. 180, pl. xiii. Regan, Trans. Roy. Soc. Edin. xlix., 1913, p. 262; and Brit. Antarct. Exped. i. 1914, p. 3, pl. i., fig. 2.

Trematomus hansoni subsp. *georgianus* Lönnberg, Swedish South Polar Exped. Fishes, 1905, p. 25, pl. v., fig. 17.

Notothenia sima Vaillant, Expéd. Antarct. Française, Poiss, 1906, p. 23.

The only two specimens preserved were taken in the fish trap, January 22nd, 1914, in Lat. 66° 28½′ S., Long. 92° 42′ E., off Queen Mary Land, in 250 fathoms.

This species may be identified as distinct from *T. loennbergii* by the greater number of rays in the dorsal and anal fins, those of our two specimens being within the range assigned by Mr. Regan. The general colour is olive green with the darker markings usual in the species of this genus.

Stomach Contents.—Remains of Cephalopods were found in the stomach, the beak of one specimen being included.

Reproduction.—The ova are small, ·9mm. in diameter, and white in colour.

Trematomus loennbergii *Regan.*

Trematomus loennbergii Regan, Trans. Roy. Soc. Edin. xlix., 1913, p. 263, pl. viii., fig. 4; and Brit. Antarct. Exped. ("Terra Nova"), 1910, i. 1914, p. 3.

Eleven examples were obtained on six occasions as follows:—Three at Station II., Lat. 66° 55′ S., Long. 145° 21′ E., in 288–300 fathoms, at a temperature of —1·8 C.; two at Station IX., Lat. 65° 20′ S., Long. 95° 27′ E., off Shackleton Ice-shelf, in 240 fathoms, the temperature being —1·38 C.; two at Station X., Lat. 65° 6′ S., Long. 96° 13′ E., off Shackleton Ice-shelf, depth 325 fathoms, temperature —1·65 C.; one taken in the fish trap on January 30th, 1914, Lat. 65° S., Long. 96° 5′ E., in 350 fathoms; one off Shackleton Ice-shelf, also taken in the fish trap, in 270 fathoms, obtained by Mr. Harrisson; two on January 22nd, 1914, in Lat. 66° 28½′ S., Long. 92° 42′ E., in 250 fathoms.

All specimens are distinctly reddish in colour, a character which enables one to easily separate them from *T. hansoni*, which is greenish in colour and the nearest ally of the species. Of more permanent value is the lower lateral line, which has 13–15 well developed tubules. *T. hansoni* may have double this number of pores, but tubules are scarcely, if at all, developed. Our largest example is 291mm. in length.

Stomach Contents.—The contents of the stomachs are digested fish and Crustaceans, determined by Mr. Whitelegge as remains of Isopods and Schizopods.

Reproduction.—The ova are yellow in colour and 1·3mm. in diameter.

Trematomus pennellii *Regan.*

Trematomus pennellii Regan, Ann. Mag. Nat. Hist. (8) xiii., 1914, p. 12; and Brit. Antarct. Exped. ("Terra Nova"), 1910, i. 1914, p. 4, pl. iii., fig. 2.

Ten specimens taken at Station VII., Lat. 65° 42′ S., Long. 92° 10′ E., off Drygalski Island, in 60 fathoms. The largest example measures 180mm. in length, and the variation in the vertical fin rays is—

D. iv.-v. 32-35; A. 29-31.

Otherwise the specimens quite agree with the description of the types.

Trematomus centronotus *Regan.*

Trematomus centronotus Regan, Ann. Mag. Nat. Hist. (8), xiii., 1914, p. 12; and Brit. Antarct. Exped. ("Terra Nova"), 1910, i. 1914, p. 4, pl. iii., fig. 1.

Four examples were obtained at Station I., Lat. 66° 50′ S., Long. 142° 6′ E., at Commonwealth Bay, at a depth of 350-400 fathoms, bottom temperature being —1·85 C.

One specimen was taken at Station XII., Lat. 64° 32′ S., Long. 97° 20′ E., the depth being 110 fathoms.

Remains of two specimens of this genus, and probably of this species, were taken from the stomach of a Weddell Seal on September 3rd, 1912, but the locality was not furnished.

The largest specimen measures 210mm. in length, equal to the size of the type; the radial formulæ of all come within the limits assigned, excepting that one example with five dorsal spines has 36 rays. Mr. Regan has defined this species as distinct from *T. pennellii* on account of its pungent spines. It may be that it inhabits deeper water, its known range extending from 100 to 400 fathoms, while *T. pennellii* has been obtained between 45 and 60 fathoms.

Trematomus scotti *Boulenger.*

Notothenia scotti Boulenger, Nat. Antarct. Exped. ii. Fish, 1907, p. 2, pl. i., fig. 1. Regan, Trans. Roy. Soc. Edin. xlix., 1913, p. 271.

Trematomus scotti Regan, Brit. Antarct. Exped. ("Terra Nova"), 1910, i. 1914, p. 4, pl. iv., fig. 2.

This striking and handsome species was taken on four occasions as follows:—One at Station VII., Lat. 65° 42′ S., Long. 92° 10′ E., off Drygalski Island, in 60 fathoms; one at Station IX., Lat. 65° 20′ S., Long. 95° 27′ E., off Shackleton Ice-shelf, in 240 fathoms, temperature —1·38 C.; three at Station XI., Lat. 64° 44′ S., Long. 97° 28′ E., off Shackleton Ice-shelf, in 358 fathoms; ten young specimens at Station XII., Lat. 64° 32′ S., Long. 97° 20′ E., off Shackleton Ice-shelf, in 110 fathoms.

The short tubular portion of the upper lateral line extending a little beyond the end of the pectoral readily distinguishes this species from *T. lepidorhinus* and *T. eulepidotus*, which are its nearest allies.

Stomach Contents.—Mr. Whitelegge has determined the stomach contents from one example as remains of *Nebalia* (Crustaceans); another specimen yielded the arm of a Crinoid.

Trematomus eulepidotus *Regan.*

Trematomus eulepidotus Regan, Ann. Mag. Nat. Hist. (8), xiii. 1914, p. 12; and Brit. Antarct. Exped. ("Terra Nova"), 1910, i. 1914, p. 5, pl. iv., fig. 3.

Four specimens were taken at Station VII., Lat. 65° 42′ S., Long. 92° 10′ E., off Drygalski Island, in 60 fathoms; and one was secured at Station XII., Lat. 64° 32′ S., Long. 97° 20′ E., off Shackleton Ice-shelf, in 110 fathoms.

Some little variation in the radial formulæ, as furnished by Mr. Regan, may be noted, two specimens exhibiting the following:—

(*a*) D. vii. 35; A. 32

(*b*) D. vi. 35; A. 32.

The two largest specimens measure 174mm. and 168mm. in length respectively.

Stomach Contents.—The material sent to Mr. Whitelegge has been identified as the remains of Schizopods.

PLEURAGRAMMA Boulenger, 1902.

Pleuragramma antarcticum *Boulenger.*

Pleuragramma antarcticum Boulenger, Rep. "Southern Cross," 1902, p. 187, pl. xviii. Vaillant, Expéd. Antarct. Française, 1906, p. 48. Pappenheim, Deutsche Südpolar Exped. 1901-3, xiii. Fische, 1912, p. 164, figs. 1, 2. Regan, Trans. Roy. Soc. Edin. xlix., 1913, p. 264.

Half a hundred small specimens were taken in the tow net at a depth of 10 fathoms in Lat. 66° 8′ S., Long. 94° 17′ E., on January 27th, 1914.

The specimens are of uniform size, about 70mm. in length. They are, therefore, younger than the type and are of more elongate proportion; they do not exhibit the straight back as figured by Boulenger, but otherwise agree quite well with the description of the species.

NOTOTHENIA Richardson, 1844.

Notothenia coriiceps *Richardson.*

Notothenia coriiceps Richardson, Voy. "Ereb" and "Terr," Fish, 1844, p. 5, pl. iii. Günther, Cat. Fish. Brit. Mus. ii., 1860, p. 261. Vaillant, Expéd. Antarct. Française, Poiss. 1906, p. 24. Pappenheim, Deutsche Südpolar Exped. 1901-3, xiii., Fische, 1912, p. 170, pl. ix., fig. 2. Regan, Trans. Roy. Soc. Edin. xlix., 1913, p. 276. Hussakof, Bull. Amer. Mus. Nat. Hist. xxxiii. 1914, p. 88.

(For description of Macquarie Island specimen see p. 64, pl. v., fig. 3.)

Many specimens were secured at the main base, Commonwealth Bay, Adelie Land, in two to five fathoms.

The collectors appear to have been impressed with the bright tints of this species, a note of the life colours of four small examples being attached to the specimens as below—

(*a*) Light crimson, ventrally crimson, shaded through pale orange to yellow, dorsally crimson mixed with light brown.

(*b*) Deep crimson with dark-brown mid line passing through orange to bright yellow ventrally.

(*c*) Reddish brown passing through greenish yellow to yellow ventrally and becoming deep brown dorsally.

(*d*) Dark reddish brown becoming deep chocolate brown towards the back and through orange to yellow below.

Stomach Contents.—The stomachs of many of the specimens were examined and the food ascertained to be algae (probably swallowed with the invertebrates), crustaceans and fishes. The latter are exclusively Notothenias, but are too far digested to be specifically determined.

ARTEDIDRACO Lönnberg, 1905.

Artedidraco shackletoni *Waite.*

Artedidraco shackletoni Waite, Brit. Antarct. Exped. 1907-9 ("Nimrod"), ii. 1911, p. 15, pl. ii. Regan, Brit. Antarct. Exped. 1910 ("Terra Nova"), i. 1914, p. 8.

The single specimen was taken on January 21st, 1914, at Station VII., off Drygalski Island, Lat. 65° 42′ S., Long. 92° 10′ E., in 60 fathoms. The first dorsal fin is damaged, but otherwise the fish agrees well with the type ; the length of the barbel and the height of the soft dorsal being proportionately the same in both specimens. The original example had the appearance of being bleached, with indications of dark markings on the anterior part of the back and the outer caudal rays. The recent specimen shows the same disposition of colour, but much more intensified. There are three dark-brown bars on the back, the last of which is placed near the termination of the upper lateral line and extends downwards to one-third the depth of the body ; the belly and underside of the hinder portion of the body are spotted with brown, and there are indications of spots on all the fins, but those on the ventrals are confined to the proximal half.

In his synopsis of this genus Regan places *A. skottsbergi* Lönnberg as the nearest ally of *A. shackletoni ;* the latter differs essentially in the high soft dorsal, the anterior and hinder rays being less than half the height of the middle ones, in the shorter pectoral, which does not reach the origin of the anal, and in the longer maxilla, which extends to below the middle of the eye. The species was originally known from one locality only in the Victoria Quadrant, the type being obtained on the "Nimrod" Expedition at Cape Royds in McMurdo Sound, in 30 to 80 fathoms. Two examples were secured

on the " Terra Nova " Expedition, at the entrance to the Sound, in 160 to 207 fathoms. The specimen taken on the " Aurora " Expedition, at a depth of 60 fathoms, extends the known distribution of the species to the other extremity of the quadrant in somewhat lower latitude.

The five described species of *Artedidraco* are as follows :—

A. mirus Lönnberg, 1905, Weddell Quadrant.

A. skottsbergi Lönnberg, 1905, Weddell and Victoria Quadrants.

A. shackletoni Waite, 1911, Victoria Quadrant.

A. lonbergi Roule, 1913, Weddell and Victoria Quadrants.

A. orianæ Regan, 1914, Victoria Quadrant.

DOLLOIDRACO Roule, 1913.

Dolloidraco longedorsalis *Roule.*

Dolloidraco longedorsalis Roule, Deux. Expéd. Antarct. Française, Poiss. 1913, p. 16, pl. iv., figs. 1-3. (*D. longidorsalis* Regan.)

(Plate I., fig. 2, and Text fig. 3.)

Five specimens were taken at Station X., Lat. 65° 6′ S., Long. 96° 13′ E., and two at Station XI., Lat. 64° 44′ S., Long. 97° 27′ E., both off Shackleton Ice-shelf, at a depth of 325 and 358 fathoms respectively, the temperature reading at Station X. being −1·65 C.

The specimens vary somewhat in size, the largest being 137mm. in total length, or larger than the type, and the smallest 100mm. The longest example differs from all the rest by having the first dorsal of greater height, equal to its distance behind the

Fig. 3. *Dolloidraco longedorsalis.*

Upper view of head. Natural size.

snout. The relative length of the rays does not accord with the type, the second being the longest and the third the shortest ; the fin also is higher than in Roule's specimens. The barbel bears a large terminal knob formed of digitate processes, which recall the

condition of a crinoid root. The smallest specimens agree in having the first dorsal fin lower than in the type, but they preserve the relative length of the rays as above described. In these some of the barbels bear a knob, while others are simple as in the type. A possible suggestion that the knob may have been lost in some of the specimens cannot be entertained, for it is found of all sizes in different individuals, being barely indicated in certain examples and in nowise comparative to the size of the fish. Mr. Regan has employed the character of the barbel as the major division in his synopsis of the genus *Artedidraco*, but the variation within the limits of the present species indicates that such character is untenable for diagnostic purposes.

Colours.—The markings are extremely striking; the ground is white but more or less clouded with yellow and with brown blotches, especially developed on the hinder portion of the body; the lower surface from vent to tail is dark brown. On the head the markings take the form of a broad bar connecting the eye and the snout, another below the eye, and another across the opercle. The numerous pores as shown in the accompanying figure have black rims; the first dorsal is uniformly black, as is also the upper half of the second fin, whose base bears spots in consonance with the markings on the upper surface of the body. This condition is reversed in the anal, the distal half being quite white, while the basal portion is black; the last rays of both dorsal and anal are connected with the caudal peduncle by a short membrane; the pectoral bears five or six brown bars, as shown in the original figure, and the lower rays are entirely black; an indistinct bar crosses the ventral; the caudal is white with an oblique black bar across its base; the upper rays bear elongate spots and a broad black bar crosses the fin obliquely, leaving a considerable portion of the ends of the rays white, the lowermost rays being scarcely involved.

Lateral Line.—The lateral line arises as four pores above the inner angle of the opercle; thence developing tubules, it falls rapidly and runs parallel to the dorsal profile to beneath the tenth ray of the second fin; it reappears as small pits in the mid line of the body and is continued to the caudal peduncle.

Reproduction.—The ova are very small, 0·8mm. in diameter, and white in colour.

The type was taken in Marguerite Bay, Fallieres Land, in the Weddell Quadrant, and we now have the species from nearly the same latitude but in the Victoria Quadrant, on the opposite side of the pole.

The largest specimen above referred to is the one figured on the accompanying plate. The species has been refigured on account of the very striking markings presented by our specimens.

In his account of the expedition, Sir Douglas Mawson * has published a coloured plate of three deep-water fishes living in the vicinity of Shackleton Ice-shelf. The two upper figures can be identified with certainty, but as regards the lower one, the

* Mawson, "Home of the Blizzard," ii., 1915, p. 270.

absence of most of its characters makes identification a matter of guess work. As much as is illustrated, however, leads me to believe that *Dolloidraco longedorsalis* was the subject of the photograph.

POGONOPHRYNE Regan, 1914.

Pogonophryne scotti *Regan.*

Pogonophryne scotti Regan, Ann. Mag. Nat. Hist. (8), xiii. 1914, p. 13; and Brit. Antarct. Exped. ("Terra Nova"), 1910, i. 1914, p. 9, pl. vi., fig. 1.

B. v.; D. ii. 25; A. 16; P. 20; V. i. 5; C. 9 + 6; L. lat. 21 + 12.

Length of head, 2·5; width of head, 3·1; depth of body, 4·4; and length of caudal, 4·0 in the length; diameter of eye, 4·8; interorbital space, 3·8; and length of snout, 4·3 in the head; gills, four, a slit behind the fourth, pseudobranchiæ present.

As some of the features of this species are to be gathered only from the excellent figure published by the author, such not being referred to in the text, the following remarks are offered on comparing our example with the illustration. The peculiar boss produced by the upper distal end of the premaxilla is situated nearer to the eye than in the type, its position being better portrayed in the illustration of the upper surface of the head; the interorbital space is concave. Within the upper angle of the opercle is a flat spine with a forwardly directed hook above.

Fins.—The spines of the first dorsal fin were evidently damaged in the type, for in our example they have a normal character; the first spine is shorter, and the second is equal in length to the diameter of the eye; all the rays of the second dorsal are longer than those figured, the second, or longest ray, being four-sevenths the length of the head, or longer than the body is deep. The caudal, ventrals, and pectorals are longer than in the type, the latter reaching to the second anal ray; the inner ventral ray is divided almost to its base.

Lateral Lines.—Head and body scaleless; the upper lateral line is arrested beneath the seventh posterior dorsal ray; the lower one, which runs along the middle of the caudal peduncle, commences two rays in advance of the termination of the upper line; both lines bear tubules.

Colours.—The general colour is grey with brown markings; the snout and the sides of the head spotted, the body with four cross bars, one behind the head, two below the dorsal fin, and one beneath its termination; dorsal, pectoral, and caudal with rows of large spots.

Length.—240mm., or smaller than the type, which measured 290mm.

Locality.—A single example obtained at Station VII., Lat. 65° 42′ S., Long. 92° 10′ E., off Drygalski Island, at a depth of 60 fathoms. The bottom records showed red algae and a few small rocks. At this station the takings were mainly animal forms, but no ooze.

Stomach Contents.—Crustaceans of the suborder *Macrura* were obtained from the stomach of this individual.

Family BATHYDRACONIDÆ.

BATHYDRACO Günther, 1878.

Bathydraco nudiceps *sp. nov.*

(Plate I., fig. 3, and Text fig. 4.)

B. vii.; D. 27; A. 22; V. i. 5; P. 22; C. 10 + 4; L. lat. 6.

Length of head, 3·0; height of body, 7·2; and length of caudal, 5·5 in the total; diameter of eye, 3·2; interorbital space, 12·0; and length of snout, 2·9 in that of the head.

Head broad and depressed, under surface quite flat, interorbital space flat, snout spatulate, lower jaw projecting, the maxilla reaches to the anterior margin of the eye. The eye is large, cuts the upper profile, and occupies the upper half of the head; the nostril is situated in a prominent tube, placed in front of the eye, midway between it and the end of the snout. Gills, four, a slit behind the fourth; gill rakers on the outer

Fig. 4.—*Bathydraco nudiceps.*

Upper view of head. Natural size.

side of the arch long and slender, 17 on the lower limb and 5 on the upper limb of the first arch. Gill openings wide, narrowly attached to the isthmus; pseudobranchiæ present. A flat blunt spine on the opercle, directed upwards and backwards. A system of large depressions is developed on the head, occurring on the upper part and sides of the snout and the interorbital space; four such depressions occupy the temporal

region, each of the series being connected by three depressions across the occiput; the eye is surrounded, and a series on the preopercle runs along the underside of the mandible, the three anterior ones being perforate and constituting large pores. Body subcylindrical, caudal peduncle quadrangular.

Teeth.—Villiform teeth in narrow bands in the jaws, wider in front, no teeth on vomer, palatines, or tongue, and no frenum.

Fins.—The dorsal fin commences at a point distant from the front of the eye equal to the length of the head, the third and fourth rays are equal and longest, the following gradually diminishing; the anal arises beneath the seventh ray of the dorsal or nearer the tip of the lower jaw than the end of the caudal; its termination is a little posterior to that of the dorsal; the pectoral is rounded, the seventh, or longest ray, reaches to the base of the third anal ray; the ventrals reach the vent; the caudal is truncate, its peduncle is long and slender, slightly longer than the eye, its depth less than one-fourth that of the body.

Scales.—Head entirely naked; body wholly covered with adherent cycloid scales. The lateral line forms a low arch over the opercle and consists of five or six large pores; a series of imperforate depressed scales forms a line from above the pectoral, thence along the midline of the body to the base of the caudal rays.

Colours.—The head and body are very pale brown above and deep brown below; the margin of the opercle is almost black; the dorsal fin is colourless; all the other fins being of dark hue.

Stomach Contents.—The contents of the stomach were identified by Mr. Whitelegge as fragments of Polychaete worms.

Reproduction.—The ova are large, being 2·6mm. in greatest diameter, and of bright yellow colour.

Length.—144mm. Type in the South Australian Museum.

Locality, etc.—The type specimen was taken at Station IX., off Shackleton Ice-shelf, Lat. 65° 20′ S., Long. 95° 27′ E., at a depth of 240 fathoms, the temperature being —1·38 C. Two other examples were taken at Station X., in the same neighbourhood, but in the deeper water of 325 fathoms, at a temperature of —1·65 C., the dates respectively being January 28th and 29th, 1914.

Remarks.—This species is well characterised, differing from those previously known by the scaleless head, the smaller number of rays in the vertical fins, and by the greater length of the ventral fins, which reach to the vent; in *B. antarcticus* Günther,* *B. macrolepis* Boulenger,† and *B. scotiæ* Dollo ‡ they fail to reach the vent by

* Günther, Ann. Mag. Nat. Hist. (5) ii. 1878, p. 18. † Boulenger, Nat. Ant. Exped. II. 1907, p. 4, pl. I., fig. 3.
‡ Dollo, Proc. Roy. Soc. Edin. xxvi., 1906, p. 65.

at least one-sixth their length. The short lateral line is also distinctive; but the sum of the characters falls well within those assigned to the genus *Bathydraco*. It may be noted that the reversed colouration is common to both *B. nudiceps* and to *B. antarcticus*.

GERLACHEA Dollo, 1900.

Gerlachea australis *Dollo*.

Gerlachea australis Dollo, Bull. Acad. Roy. Belg. Sci., 1900, p. 196; and Res. Voy. Belgica, 1904, p. 25, pl. ii., fig. 1, pl. v., fig. 2. Regan, Trans. Roy. Soc. Edin. xlix., 1913, p. 283. Roule, Deux. Expéd. Antarct. Française, Poiss. 1914, p. 10, pl. i., fig. 1; pl. ii., figs. 1, 2; pl. iii., fig. 5.

B. vi.; D. 45; A. 34; V. i. 5; P. 26; C. 10 + 6; L. lat. 85 + 6; Sc. tr. 6 + 25.

Length of head, 3·4; height of body, 12·2, and length of caudal, 7·32 in the length; diameter of eye, 4·2; interorbital space, 14·0, and length of snout, 2·4 in the head.

Head, a little wider than deep; snout, spatulate; interorbital space, concave; eye, circular, occupying two-thirds the depth of the head and placed exactly in the middle of its length; the nostril is situated an eye diameter in front of the orbit; the lower jaw is the longer, and the maxilla extends to a point half way between the nostril and the eye; gills, four, a slit behind the fourth; gill rakers represented by about eight low dentigerous patches on the first arch; gill openings very wide, narrowly attached to the isthmus, a broad truncate convex spine on the opercle; the body and tail are compressed, subquadrangular in section.

Teeth.—A narrow band of very small teeth in front of each jaw, passing into a single series on the sides; no teeth on vomer, palatines, or tongue.

Fins.—The dorsal fin commences behind the base of the pectoral, and its distance from the snout is equal to a third the total length, caudal included; the rays are of subequal height, those in front and behind being shorter; the anal commences under the twelfth ray of the dorsal, a little nearer the tip of the snout than the end of the caudal rays, and is three-fourths the length of the dorsal; the pectorals are rounded and reach the vent, which lies in the middle of the length, exclusive of the caudal; the ventral is shorter and extends to beneath the third dorsal ray; the angles of the caudal are rounded and its shorter middle rays produce a sinuous margin.

Scales.—Small scales on the cheeks and opercles, those on the latter being non-imbricate; the body is fully clothed, the scales being small and cycloid. The upper lateral line originates above the angle of the opercle, rises to below the fourth dorsal ray, thence follows the profile to below the last ray; the lower lateral line is represented by about six scales above the second fourth of the anal.

Colours.—General colour brownish yellow. A dark line passes from the snout to the eye, thence obliquely downwards across the opercles; six broad brown bars on the body, the first of which crosses the base of the pectorals. All the fins are dusky with exception of the anal, which is white; the spine and tips of the ventral rays are black.

Stomach Contents.—Crustaceans, too far digested to be determined.

Length.—208mm.

Locality, etc.—A single example netted at Station XI., Lat. 64° 44′ S., Long. 97° 28′ E., in 358 fathoms, off Shackleton Ice-shelf. The type taken, by the "Belgica," was obtained off Graham Land. Four specimens were secured off Charcot Land in the Weddell Quadrant by the "Pourquoi Pas?"

Remarks.—The above description was written before Prof. Roule's paper reached me, at which time one knew only of the single type example. Though four additional specimens were made known by the collections of the "Pourquoi Pas?," ours is still the largest recorded, and is, no doubt, fully adult, as smaller examples previously taken were found to be in ova.

Roule has mentioned that the lower lateral line is unequally developed on the two sides of the same fish, and a similar condition exists in our specimen.

ACONICHTHYS GEN. NOV.

Head, almost naked; body, wholly scaly; snout, spatulate; gill rakers, rudimentary; pseudobranchiæ present; teeth, villiform in broad bands in the jaws, without canines. A single dorsal fin, elevated in front; three lateral lines, the upper concurrent with the dorsal profile.

Of the four genera previously assigned to the family Bathydraconidæ, one, *Gymnodraco*, has the body naked; *Racovitzaia* has the scales in scattered groups; *Bathydraco* has a single lateral line; *Gerlachea* is characterised by its short second lateral line above the base of the anal; from the last named *Aconichthys* differs also by the anterior portion of the dorsal fin being conspicuously raised as in the species of *Bathydraco*.

ACONICHTHYS HARRISSONI *sp. nov.*

(Plate II., fig. 1, and Text fig. 5.)

B. vii.; D. 37; A. 29; V. i. 5; P. 22; C. 10 + 6; L. lat. 84 + 14 + 10; Sc. tr. 7 + 24.

Length of head, 3·2; height of body, 8·7; and length of caudal, 5·4 in the total; diameter of eye, 4·1; interorbital space, 28·8; and length of snout, 3·0 in the head.

Head depressed one-fourth wider than deep; interorbital space extremely narrow, slightly concave; snout wide, four-fifths the width of the head, with three ridges which coalesce in front of the interorbital; the nostril is a little nearer the eye than the tip of the snout and lies in a short tube; there is a simple pore in front and another behind

Fig. 5.—*Aconichthys harrissoni.*
Upper view of head. Natural size.

the nasal tube; the lower jaw is the longer, and the maxilla reaches to within the front edge of the eye; gills, four, a slit behind the fourth; gill rakers represented by mere knobs, of which there are 12 on the lower limb of the first arch; gill openings wide, narrowly attached to the isthmus; pseudobranchiæ present; a long narrow flat spine with serrated edge on the opercle; body rounded in front and subquadrate behind.

Teeth.—Villiform teeth in broad bands in the jaws; none on vomer, palatines, or tongue; no frenum.

Fins.—The dorsal fin commences its own length behind the snout or above the mid-length of the pectoral; the first ray is shorter than the second or third, which latter is the longest, being 2·3 in the head; the first nine rays form an anterior lobe, the rest of the rays being subequal; the anal commences beneath the seventh ray of the dorsal and extends further than that fin; the pectoral is feebly rounded, the median seven rays being subequal and one-fourth less than the head; it reaches to above the fourth anal ray. The ventral is pointed, its middle ray being nearly half the length of the head; it does not attain to the first third of the pectoral and is its own length short of reaching the anal. The caudal is slightly rounded, its peduncle above equals the length of the snout and its least depth is one-third the same.

Scales.—The head is naked, with the exception of groups of imbedded scales on the upper part of the opercle; the scales on the body are small with scalloped edges. The upper lateral line arises at the opercular notch, ascends slightly to below the first dorsal ray, thence follows the dorsal contour and terminates evenly with the last adpressed anal ray; the second lateral line is short and confined to the caudal peduncle, occupying a median position; the lower line is also short and is situated above the bases of the last 10 to 12 rays of the anal.

Colours.—The ground colour is pale olive; the upper part of the snout and head bears narrow wavy dark-brown lines of which two, passing in front and behind the eye over the opercles to the base of the pectorals, are the best defined, and are continued in a more or less broken series to the caudal peduncle. Six rectangular brown blotches cross the back, and include the upper lateral line; each is margined with a black line. The general colour below is sooty without defined markings; the fins are generally barred; while the tail has the outer rays black and its distal half sooty.

Stomach Contents.—The stomach was crowded with Crustaceans, determined by Mr. Whitelegge as Amphipoda.

Length.—278mm. Type in the South Australian Museum.

Locality, etc.—Two examples were obtained at Station X., Lat. 65° 6′ S., Long. 96° 13′ E., off Shackleton Ice-shelf, on January 29th, 1914, in 325 fathoms, temperature —1·65 C. Three specimens were taken at Station IX. also in Davis Sea, Lat. 65° 20′ S., Long. 95° 27′ E., in 240 fathoms, temperature —1·38 C. All were secured at the Western Base in the large Agassiz trawl in charge of Mr. Charles Harrisson, one of the biologists of the expedition. Mr. Harrisson was on board the Australian Federal trawler "Endeavour" when she left Macquarie Island on December 3rd, 1914. The vessel was never again heard of and, doubtless, went down with all on board.*

Note.—In Sir Douglas Mawson's book on the expedition is a plate produced by Paget colour photography of deep water fishes living in the vicinity of Shackleton Ice-shelf. The upper figure undoubtedly represents *Aconichthys harrissoni*.†

CYGNODRACO GEN. NOV.

Head very large, naked; snout spatulate; mouth not protractile; teeth villiform, in bands in the jaws; palatines and vomer edentulous; body elongate, compressed, naked, no spinous dorsal fin, lateral line single.

The scaleless body places this genus in association with *Gymnodraco* and *Parachænichthys*. From the former it differs by its long spatulate snout and extremely narrow interorbital; from the latter by the absence of bony plates on the lateral line; and from both by the large number of dorsal rays.

* Hedley, "Endeavour" Biol. Res. III. 1915, p. x. † Mawson, "Home of the Blizzard" ii., 1915, p. 270.

The removal of *Parachænichthys* from the Chænichthyidæ to the Bathydraconidæ by Mr. Regan makes the presence or absence of a spinous dorsal fin a family character.

Cygnodraco mawsoni *sp. nov.*

(Plate III., fig. 1, and Text fig. 6.)

B. vi.; D. 61; A. 36; V. i. 5; P. 22; C. 10 + 6; L. lat. 107.

Length of head, 2·5; height of body, 6·2; and length of caudal, 7·8 in the length; diameter of eye, 5·8; interorbital space, 33·0; and length of snout, 2·2 in the head.

Head somewhat compressed, long, and swan-like, its width seven-ninths of its depth; interorbital space extremely narrow, forming a groove between the eyes; the eye cuts the upper profile and is placed nearer to the opercular margin than to the end of the snout; the distance of the nostril from the tip of the snout is one-third the length of

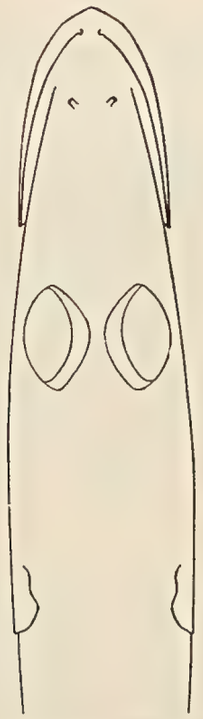

Fig. 6.—*Cygnodraco mawsoni.*

Upper view of head. Half natural size.

the snout; the lower jaw projects slightly and the maxilla fails to reach the eye by two-thirds the orbital diameter; gills, four, a slit behind the fourth; gill rakers developed as low knobs, 14 on the lower limb of the first arch; gill openings very wide, narrowly attached to the isthmus below the front edge of the eye; pseudobranchiæ present; a flat multifid spine on the opercle; body compressed, tapering evenly to the tail.

Teeth.—The villiform teeth are set in bands in the jaws, none on the other bones of the head nor on the tongue, and no frenum in the mouth.

Fins.—The dorsal fin commences above the hinder insertion of the pectoral, and its length is nearly half the total, caudal included; the rays rise gradually to the eighth or ninth, whence they are subequal as far as the twentieth, being a little less than half the length of the snout; they then decrease evenly to the last third or fourth ray. The anal originates beneath the twenty-seventh ray of the dorsal; it has three rays beyond that fin; the rays are lower than those of the dorsal. The pectoral is evenly rounded, and extends to beneath the sixteenth ray of the dorsal, or nearly its own length from the anal; its length is equal to that of the ventral. The second ray of the latter fin is the longest and attains to the middle of the body, excluding the caudal. The membrane of the spine and the first two rays are thickened and clubbed.

Lateral Line.—There is only one true lateral line, it commences above the angle of the opercle, rises to beneath the anterior dorsal rays, and follows the profile to below the tenth last ray. A broken series of depressed non-perforate scales originates slightly in advance of the insertion of the anal on the middle of the side and extends to the base of the caudal rays; these scales are separated by a space equal to the interorbital, but anteriorly are less regularly disposed.

Colours.—The ground colour is greyish-brown. A broad dark line runs along each side of the snout; there is another below and a third behind the eye directed to the subopercle; the under surface of the head is lighter but mottled; the body is adorned with seven dark bars, the first of which crosses the occiput, the second is placed in front of the dorsal fin, the next four beneath the fin, and the seventh crosses the peduncle; they become increasingly oblique backwards. All the fins are dusky, the vertical ones with darker margins; the dorsal has two dark lines running the entire length of the fin.

Stomach Contents.—Remains of fishes, too far digested to be determined, were obtained from the stomach of the fish.

Length.—466mm. Type in the South Australian Museum.

Locality, etc.—A single specimen taken at Station VII., Lat. 65° 42′ S., Long. 92° 10′ E., off Drygalski Island, at a depth of 60 fathoms.

Remarks.—This striking species is characterised by the very large size of the head, which is more than one-third the entire length, caudal included; by the remarkably narrow interorbital space, little more than a groove between the eyes; and the large number of rays in the dorsal and anal fins. The club-like rays of the ventral fin are a feature common to older specimens of many species of Antarctic fishes in the Nototheniidæ, Bathydraconidæ, and Chænichthyidæ, etc.

PRIONODRACO Regan, 1914.

Prionodraco evansii *Regan.*

Prionodraco evansii Regan, Ann. Mag. Nat. Hist. (8) xiii., 1914, p. 13 ; and Brit. Antarct. Exped. (" Terra Nova "), 1910, i. 1914, p. 10, pl. vii., fig. 1.

The specimens obtained agree well with the published description and figure. Mr. Regan states that the lower series of plates on the side of the body end in a group of nearly normal serrated scales behind the pectoral fin. The condition, as exhibited by my specimens, may be expressed by stating that the lower series of serrated plates originates in a scaly area behind the base of the pectoral and becomes better defined in its backward course. The scales along the middle of the side, about 48 in number, have depressed centres which, towards the tail, become shallow pits, producing the appearance of a line of pores. This series arises close below the origin of the tubular line, which latter is composed of 14 tubes, continued to below the sixth spine of the dorsal fin.

Length.—The largest example obtained measures 127·5mm. in length. Young specimens were collected by Mr. Harrisson at the Western Base in 270 fathoms; they measure 22mm. in length, at which size their characters are easily recognisable.

Stomach Contents.—The stomachs of the specimens preserved are crowded with the remains of small Crustaceans, identified by Prof. Haswell as of *Euphausia*, the colour of which imparts an orange tint to the abdominal region. A small amphipod was also secured from the stomach of one individual.

Locality.—Twelve specimens were preserved : two at Station VII., Lat. 65° 42′ S., Long. 92° 10′ E., off Drygalski Island, at a depth of 60 fathoms ; and 10 at Station IX., Lat. 65° 20′ S., Long. 95° 27′ E., off Shackleton Ice-shelf, at a depth of 240 fathoms, and a temperature —1·38 C. The type specimens were obtained from the Ross Sea.

Family CHÆNICHTHYIDÆ.

DACODRACO gen. nov.

Head and body naked ; operculum spinate ; snout, narrow and pointed ; no rostral spine ; no gill rakers ; pseudobranchiæ present ; a single row of small teeth in the jaws with an inner series of large spaced canines ; two dorsal fins, widely separated ; ventrals with one spine and five soft rays, of which the middle ones are the longest ; two lateral lines.

The genus differs from other forms with two lateral lines by having the lower one placed above the anal and not in a median position, and by the small number of dorsal spines (iii.), which are not higher than the rays.

Dacodraco hunteri *sp. nov.*

(Plate II., fig. 2, and Text fig. 7.)

B. vi. ; D. iii. 32 ; A. 29 ; V. i. 5 ; P. 24 ; C. 11, + 6 ; L. lat. 90 + 47.

Length of head, 2·6 ; height of body, 6·4, and length of caudal, 6·0 in the length ; diameter of eye, 4·5 ; interorbital space, 5·8, and length of snout 1·9 in the head.

Head subquadrate, deeper than wide ; snout depressed, long, and pointed, the nostril placed in front of the eye, rather more than one-fourth the length of the snout ; interorbital space wide and concave ; eye round, lateral, its front edge in the middle of the head ; the lower jaw projects slightly ; the tips of both jaws are upturned ; the maxilla extends to beneath the middle of the eye ; gills, four, a slit behind the fourth ; gill openings wide, membranes narrowly attached to the isthmus beneath the front

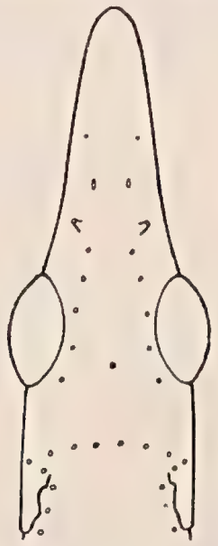

Fig. 7.—*Dacodraco hunteri.*

Upper view of head. Natural size.

edge of the eye. A broad flat spine on the opercle. A series of widely spaced pores commences near the tip of the snout, passes backwards above and behind the eye and returns to the snout close to the maxilla. Another series crosses the occiput and is continued down the preopercle and along the under jaw to its tip. The position of other pores on the upper surface of the head is illustrated in the accompanying text figure. Body and tail compressed.

Teeth.—A series of small depressible teeth on the outer margin of each jaw, and an inner series of large fixed conical teeth slightly curved backwards. These are arranged in twos, of which the anterior ones are quite small ; the larger teeth number six or seven in each ramus of the jaws. An extensive frenum in the upper jaw reaches backwards as far as the space between the nostril and the eye ; no vomerine or palatine teeth, the space they would normally occupy being covered by the frenum.

Fins.—The first dorsal fin commences in advance of the base of the pectoral; the spines are low, subequal, as long as the diameter of the eye, to which the intradorsal space is also equal; the first two rays are shorter than the succeeding ones, which are as long as the spines, but the following ones are gradually reduced. The base of the anal is as long as that of the second dorsal, but the fin has a more posterior insertion originating beneath the fifth ray, or nearly in the middle of the entire length, caudal included; the pectoral is deep and obtusely pointed, the middle rays reach to the base of the sixth anal ray; the ventrals just reach the anal; the caudal is truncate; the depth of the peduncle is little more than half the diameter of the eye.

Lateral Lines.—The upper lateral line arises above the angle of the opercle, rises to below the intradorsal space, and follows the profile to the base of the caudal rays; the lower line begins above the twelfth ray of the anal, and running near to the lower profile attains the base of the caudal rays. The lines are formed of closely set pores without any trace of scales.

Colours.—The general colour in preservative is reddish brown with seven darker bars across the body, the first two of which are slightly oblique. The first dorsal fin is black; the other fins are dusky, the pectoral being black proximally and the ventral distally.

Reproduction.—The ova are white in colour and extremely small, being ·3mm. in diameter.

Length.—211mm. Type in the South Australian Museum.

Locality, etc.—Two specimens were taken at Station XI., off Shackleton Ice-shelf, Lat. 65° 6′ S., Long. 96° 13′ E., in 325 fathoms, the temperature being −1·65 C.

Note.—This species was illustrated by Paget colour photography in Sir Douglas Mawson's book. The photograph therein reproduced was certainly taken from one of the two specimens placed in my hands. It is, however, unfortunate that the fins were not extended, but the example photographed can readily be selected by the characters portrayed.*

PAGETOPSIS Regan, 1913.

Pagetopsis macropterus *Boulenger.*

Champsocephalus macropterus Boulenger, Nat. Antarct. Exped. ii. 1907, p. 3, pl. ii. (†); Pappenheim, Deutsche Südpolar Exped. 1901-3, xiii. Fische, 1912, p. 174.

Pagetopsis macropterus Regan, Trans. Roy. Soc. Edin. xlix. 1913, p. 286.

(Text fig. 8.)

Three specimens were obtained, all from different stations as below:—The largest, 264mm. in length, was taken at Station III., Lat. 66° 32′ S., Long. 141° 39′ E., in 157

* Mawson "Home of the Blizzard" ii. 1915, p. 270, middle figure.

† The plate is wrongly marked "pl i.," but the text and also the description of the plate refer to the illustrations under "pl. ii." This will account for authors quoting differently.

fathoms, the temperature being −1·62 C. A smaller example, 170mm. long, was netted at Station XII., Lat. 64° 32′ S., Long. 97° 20′ E., the depth being 110 fathoms; while the third, of similar size, was secured at Station XI., Lat. 64° 44′ S., Long. 97° 28′ E., at a depth of 358 fathoms.

Pappenheim mentions that in his examples the lower jaw is the longer, while Boulenger describes the jaws as being equal in front. Our specimens agree in the greater length of the lower jaw, and as Boulenger's figure indicates some upward distortion of the snout, the discrepancy may be thus accounted for. Some further variation in the number of the fin rays, etc., may also be noted as below:—

Specimen.	Total Length.	Dorsal Rays.	Anal Rays.	Lateral Line.
A	264	xiii. 27	24	74 + 7
B	170	xi. 26	23	76 + 5
C	170	ix. 26	21	71 + 3

The small number of dorsal spines in the third specimen brings it within the characters assigned to *Champsocephalus* by Mr. Regan, but the high spinous dorsal, the small number of rays, and the spine on the snout all show agreement with *Pagetopsis*.

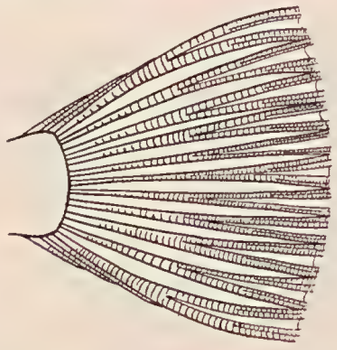

Fig. 8.—*Pagetopsis macropterus*.

Tail. Natural size.

The tails in the type specimens were incomplete. A perfect example shows that the rays are of the same length as the snout and that the margin is rounded, the exact shape being shown in the accompanying figure.

The markings in the largest specimen exactly agree with the published illustration, but those of the smaller ones exhibit seven broad bands which subdivide with age.

Stomach Contents.—The stomachs contained red seaweed and digested Crustaceans, which Prof. Haswell states are "Unrecognisable remains of some Decapods."

Habitat.—The localities above recorded form links in the chain which connects the Ross Sea and Kaiser Wilhelm Land, whence the species was previously known.

CRYODRACO Dollo, 1900.

Cryodraco antarcticus *Dollo.*

Cryodraco antarcticus Dollo, Bull. Acad. Roy. Belg. 1900, p. 130; and Voy. Belgica, Poiss. 1904, p. 20, pl. i. and v., fig. 7.

Cryodraco atkinsoni Regan, Ann. Mag. Nat. Hist. (8), xiii. 1914, p. 13; and Brit. Antarct. Exped. ("Terra Nova"), 1910, i. 1914, p. 11, pl. vii., fig. 2.

A single specimen was obtained at Station VII., off Drygalski Island, Lat. 65° 42′ S., Long. 92° 10′ E., in 60 fathoms. The type of the genus was taken in Lat. 71° 18′ S., Long. 88° 2′ W., at a depth of 450m. (= 246 fathoms), and is 200mm. in length. It is characterised by the large eye, the long ventrals, and the forward origin of the second dorsal fin. A second specimen, taken on the "Terra Nova" Expedition, is considerably larger, 292mm., and was obtained in Lat. 74° 25′ S., Long. 179° 3′ E., in 158 fathoms. It differs from the type "in the smaller eye, shorter pelvic fins, etc." A third example, now recorded, is still larger, being 451mm. in length. A review of the characters of all three specimens suggests that they are of the same species, the variations noted to be accounted for by differences of age.

The ventral fins, which form such a striking feature, are more than half the total length in the type specimen, slightly more than a third in the intermediate one, and but one-fourth in the largest. In the younger examples the ends of the longest rays are spatulate; but in the older ones they are much thickened and have grown together, forming a club-like termination. Changes in the relative length of the ventral fins, due to growth, appear to be a common feature in members of the related families Bathydraconidæ and Chænichthyidæ. Such a feature is well illustrated in the case of *Pagetopsis macropterus* Boul.* Of the two individuals figured on the plate quoted the ventral fins of the juvenile are relatively much longer than in the adult.

As with most other fishes, the eye is proportionately smaller in the largest specimen and the interorbital space is wider. Comparing the two published figures with our example, it is seen that in the smallest specimen the lower lateral line originates above the commencement of the anal; in *C. atkinsoni* it has retreated to above the sixteenth ray; while in our example it has a similar point of origin, but is somewhat broken anteriorly, and is apparently still further receding.

Respecting the relative length of the head and body compared with the caudal portion, in the type the former is the longer, while in the other two specimens the condition is reversed. The position occupied by the second dorsal fin appears to be another feature of disagreement. In the type the fin originates considerably in advance

* Boulenger, Nat. Antarct Exp. ii, 1907, Fishes, pl. ii.

of the anal, slightly so in our specimen, while in *C. atkinsoni* the anal is a little in advance. The dorsal fins really occupy a similar relative position in all specimens; the difference occurs in regard to the origin of the anal.

The characters tabulated below show the close agreement in the features of the three known specimens here associated with *Cryodraco antarcticus*—

	Specimen obtained on the—		
	"Belgica."	"Terra Nova."	"Aurora."
Dorsal rays	iii. 44	iii. 42	iii. 41
Anal rays	43	46	45
Pectoral rays	25	—	23
Caudal rays	20	—	11 + 6
Head in length	$3\frac{1}{3}$	$3\frac{1}{4}$	3·08
Body in length	8	$7\frac{1}{2}$	6·4
Eye in head	4	5	5·2
Interorbital in head	5	$4\frac{2}{3}$	4·19
Snout in head	2	2	2·1
Ventral in head	·5	·75	1·15*
Pectoral in head	1·4	1·6	1·6
Lengths in mm.	200	293	451

The three small specimens associated with this species by Pappenheim,† under the name *Pagetodes antarcticus*, are undoubtedly distinct, as recognised by Regan ‡ in the name *Cryodraco pappenheimi*. He writes:—"The fish named *Pagetodes* by Richardson ("Erebus" and "Terror" Fish., p. 15, pl. viii., fig. 3) may have belonged to the genus *Cryodraco*; but in the form of the body, the length of the pelvic fins, and the continuous dorsals, it shows more resemblance to *Pagetopsis*. Until Richardson's species is rediscovered, the name *Pagetodes* cannot be used." As the specimen on which the genus was founded was appropriated by the ship's cat before a description or proper drawing could be made, and as it is not known whether the fish was scaly or otherwise, the name *Pagetodes* may well be eliminated, for surely no one could claim that an uncharacterised species had been rediscovered. Later, Regan § questions the association of *C. pappenheimi* with *Cryodraco*, and suggests that in some of its characters it approaches *Chænocephalus*.

* In words, the ventral is twice, one and one-third, and three-fourths the length of the head respectively.

† Pappenheim, Deutsche Südpolar Exped. 1901-3, xiii. Fische, 1912, p. 175.

‡ Regan, Trans. Roy. Soc. Edin. xlix., 1913, p. 289 and footnote.

§ Regan, Brit. Antarct. Exped. ("Terra Nova"), 1910, i. 1914, p. 11.

CHIONODRACO Lönnberg, 1906.

Chionodraco kathleenæ *Regan.*

Chionodraco kathleenæ Regan, Ann. Mag. Nat. Hist. (8) xiii. 1914, p. 13; and Brit. Antarct. Exped. ("Terra Nova"), 1910, i. 1914, p. 12, pl. viii.

B. vii.; D. vi. 39; A. 34; V. i. 5; P. 22; C. 12 + 6; L. lat. 96 + 12 + 73.

Length of head, 2·8; depth of body, 7·1; and length of caudal, 6·6 in the total; diameter of eye, 4·5; length of snout, 2·1; and interorbital space, 4·2 in the head.

The head is subquadrangular in section, flat above; snout broad and spatulate; interorbital space broad and concave, with the orbital margins conspicuously raised; the eye occupies more than the upper half of the head, and its distance from the tip of the snout is more than the postorbital length; the nostril is small and placed in front of the eye, its distance therefrom being one-fourth the length of the snout; the mouth is large and horizontal, the maxilla reaching to below the first third of the eye, its length being nearly two-thirds that of the head; a large spine at the upper angle of the opercle is directed upwards and bears two points on its lower edge, and the lower angle has a double spine partially enclosed in an extensive membrane which is not included in the measurement of the head. Gill membranes very wide, narrowly attached to the isthmus; gills, four, a slit behind the fourth; gill rakers, none, pseudobranchiæ present; body moderately compressed, evenly tapering from head to tail.

Teeth.—Needle-like teeth in two rows in the jaws, the outer row being smaller, curved and visible when the mouth is closed; vomer, palatines, and tongue edentulous; a frenum behind the teeth in both jaws.

Fins.—The first dorsal arises above the margin of the opercle, its third spine is the longest and equal to half the length of the head; the second dorsal is low, its rays subequal in length and equal to the diameter of the eye; the anal is similar to the second dorsal, arising beneath its sixth ray, and has a slightly posterior insertion; the pectoral is broad and long, its longest rays equal to the distance from the end of the snout to the middle of the eye; it is truncated behind, due to the subequal length of the upper rays, the seven lower ones only being successively shorter; the ventrals are very long, the second ray being equal to the eye and snout together; they extend to the same point as the pectorals, that is, to below the base of the sixth anal ray. The caudal is short and truncated, and the depth of the peduncle is a little more than half the diameter of the eye.

Lateral Lines.—The body is entirely naked, with three lateral lines, one from the upper part of the opercle, parallel to the base of the dorsal and extending to beneath the last ray, when adpressed; the second line is short, in the middle of the caudal peduncle; the lower line commences above the origin of the anal and is coterminal with its last adpressed ray.

Colours.—The general colour is greenish, the head with brown spots above and on the upper lip, a large spot on the middle of each ramus of the mandible, a dark bar below the eye and two oblique ones behind it, eight oblique bars on the back and sides, the first dorsal wholly black, the other fins dusky, all without markings.

Stomach Contents.—Crustaceans exclusively, determined by Mr. Whitelegge as Copepods.

Length.—276mm. (Specimen "E" of the following table.)

Locality, etc.—The example described is one of two taken at Station X., Lat. 65° 6′ S., Long. 96° 13′ E., off Shackleton Ice-shelf, at a depth of 325 fathoms, the temperature being —1·65 C. Four larger specimens (355-430mm.) were secured at Station VII., Lat. 65° 42′ S., Long. 92° 10′ E., off Drygalski Island, in 60 fathoms.

Remarks.—The smaller specimens differ from the others in the absence of supra-orbital crenulations, and in the longer ventral fin, which extends to the sixth anal ray. In all specimens the fin reaches the vent, the loss of length in the longer examples is, doubtless, correlated with the characteristic thickening of the rays.

The "Terra Nova" specimens were taken in Ross Sea in 50 to 200 fathoms, and the depth is extended to 325 fathoms by the "Aurora" examples taken in somewhat lower latitude.

Differences in the radial formulæ and comparative proportions of the six specimens obtained may be thus expressed—

	A.	B.	C.	D.	E.	F.
Dorsal rays	vii. 43	v. 42	v. 51	vi. 36	vi. 38	vi. 39
Anal rays	37	35	37	36	33	34
Total length in mm.	430	418	388	355	276	240
Head in length	2·8	2·7	2·6	2·6	2·8	2·7
Depth in length	6·06	6·6	6·2	5·6	7·06	6·8
Caudal in length	7·9	7·0	6·8	7·4	6·6	5·6
Eye in head	5·7	6·0	6·2	5·7	4·5	4·6
Interorbital in head	3·6	3·8	3·6	4·1	4·2	4·2
Snout in head	1·9	2·0	2·1	2·1	2·1	2·1

Family CYCLOPTERIDÆ.

PARALIPARIS Collett, 1878.

Paraliparis wildi *sp. nov.*

(Plate IV., fig. 1, and Text fig. 9.)

B. vi. ; D. 60 ; A. 54 ; P. 20 + 5 ; C. 11.

Length of head, 4·2 ; depth of body, 4·4 ; and length of caudal, 9·8 in the total ; diameter of eye, 4·4 ; interorbital space, 1·9 ; and length of snout, 2·7 in the head.

The head is deeper than wide, and the eye is placed in the middle of its length and considerably below the profile ; the interorbital space is almost as wide as the head ; the snout is blunt and deep, nearly vertical in front, and is divided into three equal parts by the two nostrils ; the mouth is very wide and slightly oblique ; jaws equal ; the maxilla extends to below the anterior margin of the eye ; the pores on the head are large and arranged in two series on each side, seven pores in the upper and six in the lower series, the former traverses the upper border of the gape and passes below

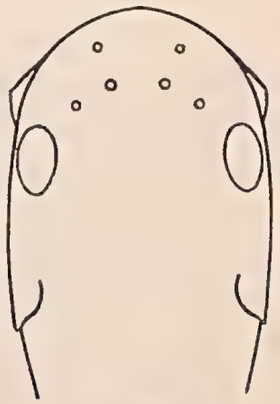

Fig. 9.—*Paraliparis wildi.*

Upper view of head. Natural size.

the eye to near the opercular angle ; the lower series similarly extends along the area below the mouth and joins the upper series, the last pore being common to both, the entire condition being shown in the figure ; gills, four, a small slit behind the fourth ; gill rakers short and conical, 11 in number on the first arch, of which six are on the lower limb, no pseudobranchiæ ; gill openings restricted, extending downwards only as far as the middle of the base of the pectoral ; the body is greatly compressed and tapers to the hypural.

Teeth.—Bands of villiform teeth in the jaws, but no teeth on the vomer, palatines, or tongue.

Fins.—The dorsal commences behind the origin of the pectoral; its distance from the snout equals one-fourth the total length, caudal included; its anterior rays are very short, but they regularly lengthen to the middle of the fin where the longest ray equals half the depth of the body; the hindermost ray is joined to the middle of the upper caudal ray; the anal arises beneath the sixth dorsal ray and has a similar form to that fin, being likewise connected to the caudal. The pectoral consists of two portions connected by three more widely-spaced rays, the upper part is the longer, its third, or longest ray, being three-fourths the length of the head; the middle ray of the lower part is almost as long, the caudal projects more than half its length beyond the points of attachment of the hinder rays of the dorsal and anal fins.

Colours.—The general colour in preservative is a pale flesh tint, but when taken from the trawl was pink throughout, as gathered from the label attached to the specimen.

Stomach Contents.—A large number of small Crustaceans, identified by Mr. Whitelegge as Amphipods, was taken from the stomach of the single specimen obtained.

Length.—187mm. Type in the South Australian Museum.

Locality, etc.—The only example secured was taken at Station X., Lat. 65° 6′ S., Long. 96° 13′ E., off Shackleton Ice-shelf, in 325 fathoms, the temperature being —1·65 C., and the bottom ooze.

Remarks.—This species differs from *P. antarcticus* Regan,* the only other species described from Antarctica,† in the following characters:—The eye is slightly smaller and the snout longer; the pores on the head are more numerous, occurring on the snout, none being so figured in *P. antarcticus*. The shape of the vertical fins is different, while the caudal is partly enclosed by the dorsal and anal membranes; the vent occupies a forward position, behind the lower portions of the pectoral, as is usual in these forms; while Regan's statement that these lower portions reach the vent would indicate that the latter is placed quite near to the origin of the anal fin, and, therefore, in a position normal to the majority of fishes. Perhaps Mr. Regan will kindly re-examine the condition in his specimen. *P. wildi* appears to be more nearly allied to the northern *P. bathybii* Collett,‡ the type of the genus. Gilbert § has recently described several new species from Southern California.

* Regan, Ann. Mag. Nat. Hist. (8) xiii. 1914, p. 11, and Zool. Brit. Antarctic ("Terra Nova") Expedition 1910, i. 1914 p. 13, pl. ii., fig. 1.

† See Addendum, p. 81

‡ Collett, Vidensk.-Selsk. Forh. Christiana, 1878, No. 14. p. 32.

§ Gilbert. Proc. U.S. Nat. Mus. xlviii. 1915, pp. 354, *et seq.* pl. xviii.

2. MACQUARIE ISLAND AND THE SUBANTARCTIC.

Though Macquarie Island on the one hand, and the Auckland, Campbell, Antipodes Islands, etc., forming the Subantarctic islands of New Zealand on the other, are here associated, it is not to be, therefore, inferred that the respective fish faunas are identical, or even closely allied. The relationship can, perhaps, be best ascertained by considering the fishes of Macquarie Island as far as, and now for the first time, made known, and afterwards make a comparison with those of the New Zealand Subantarctic islands which have been already investigated.

In this connection one cannot neglect some consideration of the fauna of the Kerguelen District, for it similarly offers a littoral between temperate and Antarctic lands.

Ten species of the following genera are now known from Macquarie Island :—

Somniosus ?

Idiacanthus aurora sp. nov.

Notosudis hamiltoni sp. nov.

Myctophum antarcticum Günther

Lampanyctus braueri Lönnberg

Notothenia coriiceps Richardson

Notothenia macrocephala Günther

Notothenia colbecki Boulenger

Harpagifer bispinis Forster

Zanclorhynchus spinifer Günther

Macquarie Island lies 850 miles S.S.E. of Hobart. It is about 21 miles in length, and of an average width of under 3 miles. It was surveyed by Mr. L. R. Blake, the geologist of the island party, and the position of the Observation Station ascertained to be Lat. 54° 31′ S., Long. 158° 58′ E.

The fishes of the Subantarctic islands of New Zealand have been determined by various ichthyologists, and in 1909 were listed by the writer.* One species, *Anguilla australis*, was omitted and three are added as a result of the collections I more recently

* Waite, Subantarctic Islands of N.Z., ii. 1909, p. 585.

made at the Auckland Islands. The fishes of this region, as far as known, therefore, are as follows :—

Euprotomicrus bispinatus Quoy and Gaimard.
Amblygaster neopilchardus Steindachner.
Anguilla aucklandii Richardson.
Anguilla australis Richardson.
Galaxias brevipinnis Günther.
Galaxias fasciatus Gray.
Galaxias attenuatus Jenyns.
Myctophum antarcticum Günther.
Syngnathus blainvillianus Eydoux and Gervaise.
Rhombosolea tapirina Günther.
Bovichthys variegatus Richardson.
Aurion effulgens sp. nov.
Notothenia coriiceps Richardson.
Notothenia macrocephala Günther.
Notothenia microlepidota Hutton.
Notothenia colbecki Boulenger.
Notothenia filholi Sauvage.
Tripterygion varium Forster.

Mr. Regan * has catalogued the fishes of the Kerguelen District; his list is here appended :—

Raia eatoni Günther.
Raia murrayi Günther.
Murœnolepis marmoratus Günther.
Notothenia squamifrons Günther.
Notothenia acuta Günther.
Notothenia mizops Günther.
Notothenia cyaneobrancha Richardson.
Notothenia coriiceps Richardson.
†*Notothenia macrocephala* Günther.
Harpagifer bispinis Forster.
Chœnichthys rhinoceratus Richardson.
Chœnichthys rugosus Regan.
Zanclorhynchus spinifer Günther.

* Regan, Brit. Antarct. Exped. ("Terra Nova"), i., 1914, p. 36. † See footnote, p. 69.

In attempting to determine the relationship of the Macquarie Island fish fauna, it must be first noted that but 10 species are known therefrom; and of these one, *Idiacanthus*, was taken in deep water, a fact which minimises its value in such connection. *Myctophum antarcticum* is a pelagic species, and ranging from temperate to Antarctic latitudes, must be eliminated from the consideration.

Mr. Regan would associate Kerguelen with Antarctica, not altogether on account of species common to both, but because they possess allied species of Notothenioiform fishes, which he enumerates. On the other hand he states that *Zanclorhynchus* is related to *Congiopodus*, a south temperate form, but does not, in this connection, mention that *Notothenia coriiceps* and *Harpagifer bispinis*, included with Antarctic species, range into Subantarctic waters.

Though the Kerguelen group, including Heard, Crozet, Marion, and Prince Edward Islands, is classed with Antarctica, Mr. Regan finds it necessary to qualify the alliance as follows:—"The only way to mark the dissimilarity of the fish fauna of Kerguelen from that of Magellan or of the Subantarctic islands of New Zealand, and to express its affinity to that of Antarctica, is to include it in the Antarctic Zone as a separate district, small and impoverished, but with well marked characters."*

Macquarie Island is certainly more Subantarctic as regards its fishes. The exclusively Antarctic genus *Trematomus* is absent from both; and we miss from Macquarie Island members of the Chænichthyidæ, of which two species occur in Kerguelen. *Lampanyctus braueri*, *Notothenia colbecki*, and *Notothenia macrocephala* are Subantarctic, but the last named is now recorded from Kerguelen. A third species, *Notothenia coriiceps*, though common in Antarctica, ranges through the Auckland Islands as far north as New Zealand. Macquarie Island and Kerguelen are associated by *Zanclorhynchus spinifer*, the genus not being known elsewhere; and *Harpagifer bispinis*, which, however, extends to Antarctic coasts. *Notosudis* is so far known only from Macquarie Island; while *Notolepis*, another member of the Sudidæ, is confined to Antarctic waters. The occurrence of a shark, provisionally associated with *Somniosus*, can scarcely be utilised in determining the zoological position of Macquarie Island; the stranded specimen was, perhaps, a waif from warmer seas.

Though I have excluded *Idiacanthus* on account of its bathybial habitat, it may be noted that, as far as known, the genus is an inter-temperate one, the Macquarie Island record constituting the highest latitude yet attained.

Though Mr. Hamilton spent almost two years (December 22nd, 1911, to November 28th, 1913) on Macquarie Island, it must not be inferred that representatives of all its permanent coastal fishes were therefore obtained. I have myself twice visited the island, and on one occasion spent two full weeks there. It is very seldom that fishing can be done, even from the rocks, owing to the high seas which are the rule rather than otherwise.

* Regan, Fishes Brit. Antarct. Exped. ("Terra Nova"), i., 1914, p. 36.

Hand lines and traps were the only appliances available, and the fact that the island party had only a small boat, rendered it next to impossible to venture beyond the shelter of the protecting rocks; as a consequence the off shore waters were not exploited.

Macquarie Island lies in higher latitude, and is also nearer the pack ice than Kerguelen Island, which latter is further south than the Crozets or Marion Island, and it might, therefore, be anticipated that the fauna of Macquarie Island would partake more of an Antarctic character than that of Kerguelen. It must be noted, however, that the island rises from deep water (to the height of 1,421ft.), a condition thus expressed by Captain Davis *—"Some idea of the steepness of the submarine mountain of which Macquarie Island forms the crest may be gathered from a sounding, taken $10\frac{1}{2}$ miles east of the island, which gave 2,745 fathoms and no bottom. In other words, if the sea were to dry up, there would be a lofty mountain rising from the plain of the ocean's bed to a height of nearly 18,000ft." The geographical proximity of the island to the Campbell and the Auckland Islands has influenced the constituents of the fauna inasmuch as it has thence received two, if not the third, species of *Notothenia*. Its association with Kerguelen is evidenced by the occurrence in both of *Harpagifer*, *Zanclorhynchus* and *Notothenia macrocephala*. It may be said, therefore, that the two groups form a broken and zigzagged series of stepping stones, those of Macquarie Island being placed nearer the Subantarctic islands, while those of Kerguelen Island, though further from the icepack, are zoologically in touch with Antarctica.

The fish fauna of the several districts here enumerated is expressed in the following table, the names of the fishes known from the Subantarctic islands of New Zealand, Macquarie Island, and the Kerguelen District being placed in the first column. The distribution of the species beyond these localities is also indicated. As before mentioned, Mr. Regan has associated Kerguelen and adjacent islands with Antarctica, but for convenience of reference they are here listed separately.

* Davis, in Mawson's "Home of the Blizzard" ii. 1915, p. 30.

DISTRIBUTION OF THE FISHES OF MACQUARIE ISLAND, THE KERGUELEN DISTRICT, AND THE SUBANTARCTIC ISLANDS OF NEW ZEALAND.

	Macquarie Island.	Kerguelen Island.	Subantarctica.	Antarctica.	South Temperate Zone.
Somniosus ?	x	—	—	—	—
Euprotomicrus bispinatus	—	—	Campbell Island	—	New Zealand, Mauritius, Indian Ocean
Raia eatoni	—	x	—	—	—
Raia murrayi	—	x	—	—	—
Amblygaster neopilchardus	—	—	Auckland Islands	—	Australia, New Zealand.
Anguilla aucklandii	—	—	Auckland Islands	—	Australia, New Zealand, S. Pacific.
Anguilla australis	—	—	Auckland Islands	—	Australia, Tasmania, New Zealand, Timor.
Galaxias brevipinnis	—	—	Auckland Islands	—	New Zealand.
Galaxias fasciatus	—	—	Auckland Islands	—	New Zealand, Chatham Island.
Galaxias attenuatus	—	—	Campbell Island, Magellan, Falkland Islands	—	Australia, Tasmania, New Zealand.
Idiacanthus aurora	x	—	—	—	—
Notosudis hamiltoni	x	—	—	—	—
Myctophum antarcticum	—	—	Circumpolar from Lat. 64° 14′ S. to Lat. 28° 0′ S.		—
Lampanyctus braueri	x	—	Off Falkland Islands	Coates Land	—
Syngnathus blainvillianus	—	—	Auckland Islands	—	New Zealand, S. America.
Murænolepis marmoratus	—	x	—	—	—
Rhombosolea tapirina	—	—	Auckland and Campbell Islands	—	Australia, Tasmania, New Zealand.
Bovichthys variegatus	—	—	Snares, Auckland, and Campbell Islands	—	Australia, New Zealand.

DISTRIBUTION OF THE FISHES OF MACQUARIE ISLAND, THE KERGUELEN DISTRICT, AND THE SUBANTARCTIC ISLANDS OF NEW ZEALAND—*continued.*

	Macquarie Island.	Kerguelen Island.	Subantarctica.	Antarctica.	South Temperate Zone.
Aurion effulgens	—	—	Auckland Islands	—	—
Notothenia squamifrons	—	x	—	—	—
Notothenia acuta	—	x	—	—	—
Notothenia mizops	—	x	—	—	—
Notothenia cyaneobrancha	—	x	—	—	—
Notothenia coriiceps	x	x	Auckland Islands	S. Georgia, S. Orkneys, Graham Land, Victoria Land	—
Notothenia macrocephala	x	x	Auckland and Campbell Islands, Magellan, Falkland Islands	—	New Zealand, Chili.
Notothenia microlepidota	—	—	Snares, Auckland, and Campbell Islands	—	—
Notothenia colbecki	x	—	Auckland, Campbell, and Antipodes Islands	—	—
Notothenia filholi	—	—	Campbell Island	—	—
Harpagifer bispinis	x	x	Magellan, Falkland Islands	S. Georgia, S. Orkneys, Graham Land	Patagonia.
Chænichthys rhinoceratus	—	x	—	—	—
Chænichthys rugosus	—	x	—	—	—
Tripterygion varium	—	—	Snares, Auckland Islands	—	New Zealand, Chatham Island.
Zanclorhynchus spinifer	x	x	—	—	—

? Family SCYMNORHINIDÆ.

? Somniosus *sp.*

(Text fig. 10.)

Under date, August 17th, 1913, Mr. Hamilton wrote :—" I am sending you a rough drawing of an Elasmobranch which was cast up on to the beach last year. It measured 8ft. 2in. in length, and I preserved the teeth and portion of the skin. None of the sealers has seen a shark here before ; it probably drifted down from warmer seas."

Though not a specialist in the group, Mr. Hamilton has had a biological training, and his sketch may be referred to for general features, though additional details, which one would desire, were not noted.

The following are the principal characters revealed by the sketch which is here reproduced :—Body stout ; two dorsal fins, apparently without spines, and in normal position ; no anal fin ; eye small ; snout short ; mouth inferior ; gill openings small, five in number ; caudal short.

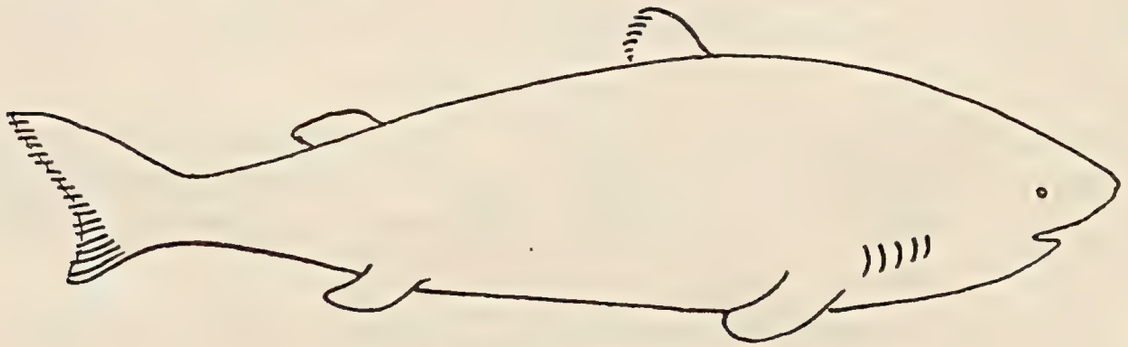

Fig. 10.— *? Somniosus* sp.

Sketch by H. Hamilton. One-eighteenth natural size.

In attempting to identify the sketch with members of known genera it may be well to indicate how the deductions were made.

The sum of the characters above indicated limits the shark to the Squaloidei. It next becomes a question as to whether the dorsal fins were each preceded by a spine, or whether such spines were absent. In the majority of the genera of the Squalidæ the spines are pronounced and could scarcely be overlooked ; but in *Centroscymnus*, for example, they are almost hidden and scarcely to be seen unless looked for. Presuming, for the present, that dorsal spines were absent, the Squalidæ is disposed of, and the Echinorhinidæ, with its posteriorly placed dorsal and the characteristic Pristiophoridæ may also be eliminated. The family Scymnorhinidæ, therefore, alone remains, and with this the characters of the sketch fully accord.

Accepting the classification adopted by Garman* the Scymnorhinidæ includes five genera :—

Euprotomicrus has the first dorsal much smaller than the second, a large eye, a median tooth, and only 23 teeth in the lower jaw.

The teeth of *Scymnorhinus* are still fewer in number, there being but 19 in a series in each jaw ; the eye is large ; the body slender ; and the caudal comparatively long.

The little *Isistius*, with its large eye and lower triangular teeth in 31 rows, is quite characteristic.

Heteroscymnus and *Somniosus* are so nearly alike externally, and possibly also in the character of the teeth, that their number can, in the present connection, be our only guide. In the former genus, compared with *Euprotomicrus* by its author, the teeth are in small and equal number in each jaw, namely 18 ; while in *Somniosus* the series is much larger and the number of teeth differ greatly in the two jaws.

In the Macquarie Island specimen the upper teeth, 44 in number, are raptorial ; while the lower series, to the number of 56, are sectorial, and there is no median tooth. As regards their character they agree quite well with those of *Somniosus ;* but in this genus, as far as I know, the number of tooth series in the upper jaw exceeds those of the lower jaw.

Some of the Squalidæ likewise possess teeth of dual character, and in *Centroscymnus* they approach those under consideration, but again are more numerous in the upper than in the lower jaw. The reverse obtains in *Etmopterus*, but the teeth are of different character.

Lastly, the scales in the fragment of skin agree with those of *Somniosus*, being small, non-imbricate, and slightly hooked tubercles. Here the matter must be left for the present.

For convenience the shark is referred to as *? Somniosus*, but it possibly may not belong to that genus, and may indeed be one of the Squalidæ, though the material at hand is insufficient for more certain identification.

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* Garman, Mem. Mus. Comp. Zool. xxxvi. 1913. p. 233.

Family STOMIATIDÆ.

IDIACANTHUS Peters, 1876.

Idiacanthus aurora *sp. nov.*

(Plate V., fig. 1, and Text fig. 11.)

B. xvi.; D. 60; A. 37; V. 6; C. 15 + 10; Vert. 31 + 19 + 32.

Length of head, 14·8; and that of caudal, 24·0 in the length; diameter of eye, 5·4; interorbital space and length of snout, 4·5 in the head.

The head is compressed, its depth two-thirds its length, the gape extends nearly to the margin of the opercle. The barbel, attached to the membrane behind the mental symphysis at one-fourth the length of the mandible, is nearly two and a half times the length of the head; the distal dilation is nearly one-third the length of the barbel and consists of a main broad portion, narrowly margined before and behind with

Fig. 11.—*Idiacanthus aurora.*

Upper view of head. Natural size.

membrane, bearing an auxillary branch at its proximal end and a pair of smaller ones near its tip. The tongue is large and has a small, though distinct, papilla at its tip. The eye is in the anterior half of the head; a small phosphorescent organ lies behind the eye close to the maxilla. Gills, four, the first free, the others broadly united, a small opening behind the fourth; no gill rakers; pseudobranchiæ absent.

Teeth.—The teeth are needle-like, with wide compressed bases, wholly depressible, and set in a single series in each jaw; they are of very unequal length, as shown by the following consecutive measurements in millimetres computed from before backwards * :—

Upper jaw, 1, 2, 5, 2, 4, 5, 2, 4, 3, 4, 5, and a graduated series of six teeth 2mm. to 3mm. in length.

* Made by my assistant Mr. Herbert M. Hale.

Lower jaw, 1, 1, 3, 4, 5, 7, 2, 3, 4, 5, 2, 3, 4, 4, 1, 1, 1, 1, and eight minute teeth.

One median and two lateral pairs of curved teeth are found on the vomer, and a single similar tooth in the middle of each palatine; three irregularly disposed teeth on the tip of the tongue, and a single median tooth further back.

Fins.—The distance between the tip of the snout and the origin of the dorsal is three-fourths the distance between the same point and the end of the caudal, in other words the fin commences three-sevenths the total length behind the tip of the snout; the ventral is placed beneath the origin of the dorsal and the anal arises below the twenty-fourth ray of the dorsal, or at the second third of the total length, caudal excluded, its point of origin being midway between the first dorsal ray and the base of the caudal.

Colours.—Head, body, fins, iris, and within the mouth entirely black.

Length.—425mm. Type in the South Australian Museum.

Locality, etc.—Twenty-five miles northward off Macquarie Island in 1450-636 fathoms.

Remarks.—The single example was obtained during the second Subantarctic cruise, 1912, under Prof. Flynn. The fish is in a dilapidated condition, the skin hanging in shreds from the body; the head is intact and the position of the vertical fins is assured, but having floated off with the skin the actual position of the ventral fins during life cannot be ascertained with certainty. The photophore on the head has been already referred to; but those probably on the body cannot now be discovered. Under such circumstances no complete description can be made, but some points of affinity or difference may be briefly discussed, and the tentative name, *I. aurora*, may be used for convenience of quotation. Five species have been previously described, namely :—

I. fasciola Peters, Monatab. Akad. Wiss. Berlin, 1876, p. 847.

I. (*Bathyophis*) *ferox* Günther, Ann. Mag. Nat. Hist. ii. 1878, p. 181; and Chall. Rep. xxii. 1887, p. 216, pl. lii., fig. D.

I. antrostomus Gilbert, Proc. U.S. Nat. Mus. xiii., 1890, p. 54; Garman, Mem. Mus. Harvard, xxiv. 1899, p. 280.

I. atlanticus Brauer, Wiss. Ergebn. der Deutschen Tiefsee Exped. (" Valdivia "), xv. 1906, p. 62.

I. niger Regan, Ann. Mag. Nat. Hist. (8), xiii. 1914, p. 14; and Zool. Brit. Antarctic (" Terra Nova ") Exped., 1910, i. 1914, p. 14, pl. x., fig. 2.

So far I have been unable to consult the description of *I. atlanticus*, and the characters of this species are omitted from the following table of comparisons, which, however, in consequence of the different methods of computation, is very incomplete.

	I. fasciola.	*I. ferox.*	*I. antrostomus.*	*I. niger.*	*I. aurora.*
Branchiostegals	xviii.	—	xii.	—	xvi.
Dorsal rays	70	60	55-57	59	60
Anal rays	41	45	33-34	38	37
Vertebræ	—	22 + 17 + 30	Ca. 79	—	31 + 19 + 32
Head in length	—	1/14	1/12	2/27	1/14
Snout to ventrals in the length	—	1/3	—	3/8	2/5
Eye in head	—	—	7·0	8·5	5·8
Interorbital in head	—	—	—	5·0	4·8
Barbel in head	—	×2	×2	×2	×2·3
Origin of dorsal	Nearer to head than ventrals	Opposite ventrals	Advance of ventrals	Behind ventrals	Opposite ventrals
Origin of anal	—	—	—	Nearer caudal than ventrals	Midway between caudal and ventrals
Origin of ventrals	—	Midway between head and vent	—	Midway between head and anal	Nearer anal than head
Total length in mm.	51,127 *	227	115	400	425
Lower jaw, length	—	14	—	28	27
Barbel, length	—	24	—	58	69
Length to caudal	—	192	—	380	408
Length to dorsal	—	66	—	170	177
Length to ventrals	—	66	—	150	177
Length, ventrals to anal	—	58	—	120	109
Length, origin of anal to caudal	—	68	—	110	122
Locality	N. Australia N. New Guinea	N. Atlantic	S. California	Cape North New Zealand	Off Macquarie Island
Depth in fathoms	Surface	2,750	603	†	1,450

Taking its geographical position into account one would seek to associate *I. aurora* with *I. niger*, but in the latter species the number of branchiostegal rays and vertebræ, both of which indicate considerable differences in the several species, were not counted; the larger eye, longer barbel, the backward situation of the ventrals, and the more forward position of the anal are characters which require considerable allowance for variation if the two species are to be regarded as identical. Regan has figured the barbel as arising at the mid-length of the mandible, whereas in our example it originates at the first third of the length, a position in agreement with the figure and description of *I. ferox* and *I. antrostomus* respectively.

* Two specimens.

† "From the stomach of a Groper" (? *Polyprion oxygeneios* Bloch and Schneider, or if from deep water more probably *P. americanus* Bloch and Schneider, see Waite, Trans. N.Z. Inst. xlv. 1913, p. 215).

Family CLUPEIDÆ.

AMBLYGASTER Bleeker, 1849.

Amblygaster neopilchardus *Steindachner.*

Clupea neopilchardus Steindachner, Denk. K. Akad. Wiss. Wien, xli. 1879, p. 12.

Clupanodon neopilchardus Waite, Mem. Aust. Mus. iv. 1899, p. 53.

In an account of the birds of the Subantarctic islands of New Zealand I described how specimens obtained from myriads of shags (*Phalacrocorax colensoi*), observed at the Auckland Islands, were found to be feeding upon the crustacean *Munida subrugosa*, and that in one instance only were small fish bones found in the stomach of one of the birds.*

My visit in the "Aurora" constituted the third occasion on which I had set foot on the Auckland Islands, and on request, Captain Davis put me ashore on Figure-of-Eight Island, in Carnley Harbour, where I spent the whole day (June 27th, 1912) and obtained the fishes noted in this article. As on the previous occasion I caught some of the shags of which one of the many colonies frequenting this beautiful harbour is located on Figure-of-Eight Island. My raid on this occasion was the means of adding the pilchard to the known fauna of the group, for as soon as they were caught the birds obligingly deposited their dinners at my feet.

Family SUDIDÆ.

NOTOSUDIS gen. nov.

Head as broad as deep; snout long, subacute; mouth large, the premaxilla forms the gape, reaches beyond the eye, and is free from the maxilla, a supramaxilla present. A single series of teeth in the jaws, on the palatines, and a band on the vomer; body elongate, subcylindrical; dorsal fin short in a median position, an adipose fin present; pectoral fins normal; ventral fins unknown; anal short, in advance of the adipose; caudal with numerous procurrent rays; scales presumably present, but completely lost; lateral line well developed.

The specimen on which this genus is founded is very imperfect, the scales and ventral fins being absent; the position of the vent and other characters are not ascertainable; the affinities of the genus are not, therefore, easy to determine; but the features, as far as at present known, lead me to ascribe it to the family Sudidæ. The fact that the entire head of the vomer is dentigerous scarcely agrees with the diagnosis of the family, but the enlarged lateral patches show affinity with those forms in which the teeth constitute two widely separated groups, the intermediate teeth in *Notosudis* being comparatively inconspicuous.

* Waite, "Subantarctic Islands of New Zealand," ii. 1909, p. 582.

Notosudis hamiltoni *sp. nov.*

(Plate V., fig. 2, and Text fig. 12.)

B. x.; D. 12; A. 15; P. 12; V. ?; C. 19 + 22.

Length of head, 4·3; depth of body, 8·2 in the length; caudal incomplete; diameter of eye, 5·3; interorbital space, 4·1; and length of snout 3·5 in the head.

Head flat above, cheeks vertical, snout acute but rounded at the tip, formed by the premaxilla which extends beyond the eye a third of the orbital diameter, or to beyond the middle of the head; it is free from the maxilla, which is dilated behind; the depth of the supramaxilla is equal to the combined depths of the distal extremities of the premaxilla and maxilla; mouth large, slightly oblique, the lower

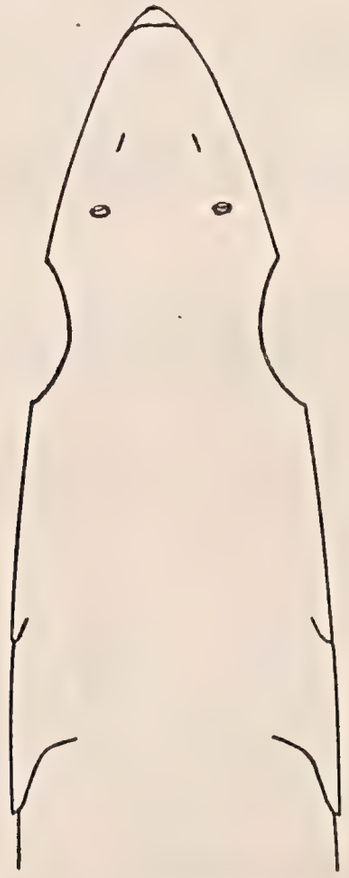

Fig. 12.—*Notosudis hamiltoni.*
Upper view of head. Natural size.

jaw the longer, fitting into a low notch in the premaxilla; the posterior nostril is transverse, has an upward aspect, and lies in front of the eye one-fourth the distance of the orbit from the snout; eye large and lateral, extending from within the dorsal profile almost to the maxilla below, wholly in the anterior half of the head; gills, four, an opening behind the fourth; gill rakers, confined to the lower limb, to the number

of about 20 on the first arch, those on the anterior half being small knobs merging into strong needle-like spines on the hinder portion ; gill membranes very wide, free from the isthmus ; no pseudobranchiæ ; opercles thin, unarmed.

Teeth.—A single series of small closely-set conical teeth in both jaws, and a larger depressible series on the palatines ; a narrow band of depressible teeth on the vomer, in the form of a horseshoe, four teeth on each extremity being considerably larger ; tongue smooth.

Fins.—The first dorsal fin lies in the middle of the total length, caudal included ; its base is short, less than twice the diameter of the eye ; all the rays are broken ; the third and fourth are the strongest and probably the longest, the portions remaining being as high as the fin is long ; the adipose fin is well developed, its height being equal to the diameter of the eye and its distance behind the dorsal equals that from the opercular margin to the base of the first dorsal ray ; the anal base is three-fourths that of the dorsal, the fin lies in advance of the adipose, the front edge of which is above the last anal ray ; the pectorals lie relatively high but are badly damaged ; the longest rays of the caudal are broken ; the tail is deeply forked and supported by numerous procurrent rays above and below ; the peduncle is a little deeper than its length and is three and a half times the diameter of the eye.

Scales.—All scales, excepting those remaining on the lateral line, have been lost ; but judging from the pits they were moderately large ; the lateral line is very pronounced where still existing, and there are about 24 pores in a space equal to the length of the head. On the hinder part of the body the line occupies a median position, but its anterior course is unknown.

Length.—505mm. to the end of the longest broken caudal ray. Type in the South Australian Museum.

Locality.—Macquarie Island.

Remarks.—This mutilated specimen was picked up on the beach by Mr. Harold Hamilton. It has the appearance of having been considerably digested, and was probably ejected by a seal. There still remains enough, however, to enable such a description and figure to be made as will probably be sufficient for the recognition of any example of the species that may be hereafter obtained.

I have pleasure in associating with this specimen the name of Mr. Harold Hamilton, who acted as zoologist for the expedition at Macquarie Island. He is the son of my old friend, the late Augustus Hamilton, Director of the Dominion Museum, Wellington, New Zealand, and by a lengthened stay on the island carried into effect a wish that his father had expressed after returning from a disastrous trip to Macquarie Island in 1894 :—" I should certainly liked to have had the opportunity of staying for 12 months on the island to complete a year's observations, the few days which we spent there being quite inadequate for observations of much value." *

* Hamilton, Trans. N.Z. Inst. xxvii. 1895, pp. 559-579.

Family MYCTOPHIDÆ.

MYCTOPHUM Rafinesque, 1810.

Myctophum antarcticum *Günther.*

Scopelus antarcticus Günther, Ann. Mag. Nat. Hist. (5) ii. 1878, p. 184; and Chall. Rep. xxii. 1887, p. 196, pl. li., fig. D.

Scopelus colletti Lütken, Spolia Atlantica, ii. 1892, p. 249, fig. 7. (*Geopelus colletti* Lütken, *fide* Brauer.)

Benthosema colletti Goode and Bean, Oceanic Ichth. 1895, p. 78.

Myctophum antarcticum Lönnberg, Fishes of Swedish South Polar Exped. 1905, p. 60. Brauer, Wiss. Ergebn. der Deutschen Tiefsee Exped. ("Valdivia") xv. 1906, 168, fig. 82, a-c.

(Plate IV., fig. 2, and Text fig. 13.)

B. viii.; D. 14; A. 21; V. i. 7; P. 16; C. 19 + 12; L. lat. 39, L. tr. 3 + 6.

Length of head, 3·6; height of body, 3·8; and length of caudal, 4·0 in the total length; diameter of eye, 2·42; interorbital space, 4·14; and length of snout, 8·3 in the head.

Fig. 13.—*Myctophum antarcticum.*

Upper view of head. Twice natural size.

Mouth subhorizontal, the maxilla extends a little further than the hinder margin of the orbit; its distal extremity is dilated, the preopercle nearly vertical; the gill rakers are long, 29 on the first arch, of which nine are on the upper limb.

Fins.—The dorsal commences slightly nearer to the tip of the snout than to the base of the caudal rays; the length of its base is equal to that of its third, or longest ray, which is also the length of the maxilla. The origin of the adipose fin is midway between the hinder insertion of the dorsal and the base of the caudal rays. The anal overlaps

the dorsal by the length of one scale; it is lower, but its base is more than one-half longer than that of the dorsal. The ventral is inserted wholly in advance of the dorsal. The length of the pectoral is six-sevenths that of the head. The caudal peduncle is comparatively short and stout, its least depth being one-third the length of the head or 2·7 in the depth of the body.

Scales.—The scales are deciduous; but those of the lateral line and those bearing the photophores are more adherent. The scales of the lateral line are vertically enlarged, their depth being twice that of the others, while the largest measure one-third the length of the head.

Photophores—

Anteorbital.—A luminous area in which the nostrils are situated.

Mandibular.—Three. (Brr.)

Opercular.—Three (Op.) behind the preopercular border, and one (P.L.O.) underneath the edge of the opercle.

Pectoral (P.V.O.).—Two, one on the base of the pectoral fin, the other close behind the edge of the opercle.

Anterolateral (V.L.O.).—One, above the base of the ventral fin.

Mediolateral (S.A.O.).—Three, the two lower ones form a straight horizontal line with the Anterolateral; the upper one, which forms a somewhat obtuse angle with the lower ones, is placed close to the lower edge of the lateral line, over the insertion of the anal.

Posterolateral (Pol.).—None.

Thoracic (P.O.).—Five, the last raised and in front of the ventral fin.

Ventral (V.O.).—Four, the first close behind the fin and the lowest of the series.

Anal (A.O.).—Seventeen, forming an unbroken series, the tenth being raised and situated below the adipose fin.

Caudal (Prc.).—Two, slightly detached from the anal series.

Supercaudal (p.).—Occupies the length of three scales but is not divided (= Leuchplatte).

Length.—64mm.

Locality.—The specimen described and figured was washed aboard the "Aurora" during the night of June 23rd, 1912, when we experienced very heavy weather, the position being between the Macquarie and Auckland Islands, Lat. 52° 30′ S., Long. 162° 0′ E. Six further examples were taken in the tow net, south-west of Tasmania, in Lat. 45° 0′ S., Long. 138° 0′ E. Two individuals were picked up on the beach at Macquarie Island by Mr. H. Hamilton after a storm on March 2nd, 1913. These are considerably abraded, but are of large size, measuring 115mm. in length.

Remarks.—Lütken's diagram does not illustrate the scales, and some slight variation in the position of the photophores is also to be noted. Günther's figure does not show the situation of the photophores very clearly, and it may be observed that seven are incorrectly described and figured in the position of the mediolaterals. At the date of publication of the "Challenger Report" the importance of the number and disposition of the photophores was not realised, it being left to Raffaele,* Lütken,† and later to Brauer‡ to elaborate the scheme of nomenclature. The last-named author has designated the photophores by letters which facilitate marking diagrams, but he generally adopts the classification already in vogue; the upper "opercular" photophore has received a distinctive character, "P.L.O." The letters used are inserted after the ordinary nomenclature in the above description. In the paper referred to he revises the classification of the family. Excluding *Neoscopelus*, he recognises one genus only (*Myctophum*), with three subgenera, *Myctophum*, *Nyctophus*, and *Lampanyctus*. Had full generic rank been accorded, some of the undoubtedly useful subdivisions already proposed could have been used subgenerically.

Myctophum antarcticum has a circumpolar distribution outside the Antarctic Circle, but has been taken within it in the Victoria Quadrant.

LAMPANYCTUS Bonaparte, 1840.

Lampanyctus braueri *Lönnberg.*

Myctophum (*Lampanyctus*) *braueri* Lönnberg, Fishes, Swedish South Polar Exped. 1905, p. 64, fig. 1.

(Text figs. 14 and 14a.)

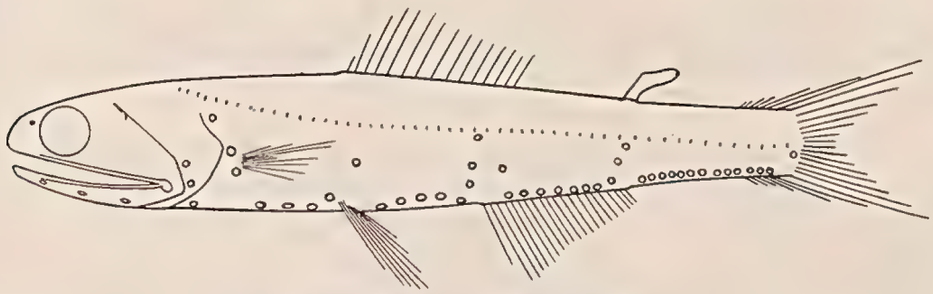

Fig. 14.—*Lampanyctus braueri.*

Natural size.

Three specimens were found on the beach at Macquarie Island, March 2nd, 1913. They were more or less damaged; but where one is defective the others chance to be undamaged, so that the fish may be reconstructed, excepting as regards the fins and scales. There is little doubt that they are correctly identified with this species, the

* Raffaele, Mitt. Zool. Stat. Neapel, ix. 1889, p. 179. † Lütken, Spolia Atlantica, Viden. Selsk. Skrift. vii. 1892, p. 223.
‡ Brauer, Zool. Anzeig. xxviii. 1905, p. 377.

type of which, taken off the Falkland Islands, was also damaged, facts which will account for the following differences noted as regards the number and position of the photophores.

The opercular (Op.) forms an oblique line with the first thoracic (P.O.) and not an obtuse angle as figured in the type. The pectorals (P.V.O.) lie one at the upper and one at the lower base of the fin ; not both below the base. Of the " six ventrals "

Fig. 14A.—*Lampanyctus braueri.*

Upper view of head. Twice natural size.

(V.O.) I can find but five. The mediolaterals (S.A.O.), together with the last pore of the ventrals, form an obliquely vertical line of four pores, or one more than figured by the author.

The accompanying diagram indicates the relative position of the photophores as revealed by the Macquarie Island examples, the largest of which measures 115mm. in length without the caudal.

Family BOVICHTHYIDÆ.

AURION gen. nov.

Head and body naked, a luminous organ in front of the head. Teeth in several series in front in the jaws, present also on the vomer and palatines. Opercle with a very strong spine. Origin of the first dorsal above the opercle ; rays of all the fins branched excepting the lower ones of the pectoral, which are thickened and partly free distally.

This genus agrees with *Bovichthys* in the naked body, presence of a strong opercular spine and the character of the pectoral fin, but differs by having a luminous organ in front of the head, by the less forward position of the spinous dorsal, the uniform character of the anal, and by its pelagic habit, the species living in the open sea at or near the surface.

As far as known, all other members of the family are of littoral habit, and the best known species of the type genus in Australasian waters (*Bovichthys variegatus* Rich.) is one of the commonest denizens of the rock pools. Representatives of other Notothenioid families do live in the open sea, as remarked by Regan,* but, apparently, all in fairly deep water; such genera are *Bathydraco*. *Gerlachea*, and *Racovitzaia* of the family Bathydraconidæ, and *Cryodraco* of the family Chænichthyidæ.

Aurion effulgens *sp. nov.*

(Plate IV., fig. 3.)

B. vii.; D. viii. 20; A. 16; P. 15; V. i. 5; C. 14 + 12; L. lat. 84.

Length of head, 3·1; height of body, 2·81; and length of caudal, 4·09 in the length; diameter of eye, 3·26; interorbital space, 4·7; and length of snout, 4·0 in the head.

Head slightly compressed with upper profile rounded; eye lateral, a little removed from the profile, and with a marked supraorbital ridge; the interorbital space is slightly concave, but concealed from between the eyes forward by a pair of leaf-like luminous organs, the outer edge of each leaf overhangs the eye and the petioles unite on the front part of the snout; the nostril lies in front of the base of the lobe of the leaf and has a complete raised margin; mouth horizontal and protractile, the maxilla expanded behind and extending to below the first third of the eye; opercular spine very strong and longer than the eye: gills four, a slit behind the fourth; gill rakers moderate, nine on the lower limb of the first arch; pseudobranchiæ present; body strongly compressed.

Teeth.—Several series of minute teeth in the front of the jaws, also on the vomer and palatines; a frenum in the upper jaw.

Fins.—The first dorsal commences slightly in advance of the edge of the opercle, its first spine is the highest, one-half longer than the eye. The following spines regularly diminish in height, the last being one-fourth the height of the first; the second fin arises close behind and its base is twice that of the first fin. The rays rise gently to the seventh, which is a little higher than the first spine. The anal commences beneath the sixth dorsal ray, is lower than that fin, and has its margin incised. The pectoral is broad and rounded and reaches to the second anal ray, its length being 1·27 in the head; the seven lower rays are undivided. The ventral is inserted in advance of the pectoral; the spine is long, nearly twice the diameter of the eye, and its second, or longest ray, reaches to the vent; the rays are not thickened. The caudal is slightly emarginate with the lobes rounded, its peduncle is shorter than its depth, which equals the diameter of the eye.

* Regan, Trans. Roy. Soc. Edin. xlix., 1913, p. 251.

Lateral Line.—There are 84 pores in the lateral line which commences with a low arch above the opercular spine ; it runs parallel to the dorsal profile, but at some distance therefrom, traverses the middle of the caudal peduncle and reaches the base of the middle caudal ray.

Colours.—When alive, of intense blue with colourless fins, the frontal organs whitish and translucent.

Length.—53·5mm. Type in the Canterbury Museum.

Locality.—One example obtained south-west of Adam's Island, Auckland Islands, Lat. 50° 60′ S., Long. 165° 0′ E.

Remarks.—The little fish was washed on to the deck of the "Aurora" during a heavy sea on June 24th, 1912, and handed to me alive by one of the seamen. It appears to be the only member of the Notothenioid fishes so far recorded as living at the surface of the open sea.

Family NOTOTHENIIDÆ.

NOTOTHENIA Richardson, 1844.

Notothenia coriiceps *Richardson* var. macquariensis *nov.*

Notothenia coriiceps Richardson, Voy. "Ereb." and "Terr.," Fish, 1844, p. 5, pl. iii.

(For references see page 22.)

(Plate V., fig. 3, and Text fig. 15.)

B. vi. ; D. vi. 33-34 ; A. 28 ; P. 22 ; V. i. 5 ; C. 12 + 6 ; L. lat. 53 + 14 – 54 + 22 ; Sc. 68 – 72 ; Sc. tr. 10 + 26.

Length of head, 3·2 ; height of body, 4·4 ; and length of caudal, 5·6 in the length ; diameter of eye, 5·9 ; interorbital space, 3·1 ; and length of snout, 3·5 in the head.

The head is depressed and flat to between the nostrils, falling slightly to the lips ; the eye is sublateral, its upper edge close to the profile ; a low ridge from the front of the eye to above the nostril ; the maxilla reaches to below the middle of the eye, the jaws are equal ; the preopercle is inclined slightly backwards below. The gill-rakers are of moderate length, the longest being one-third the diameter of the eye ; there are 16 on the first arch, 10 of which are on the lower limb.

Teeth.—A single row of widely-spaced canines in each jaw, and a band of smaller teeth behind, extending backwards almost to the angle of the mouth.

Fins.—The dorsal commences over the edge of the opercle, and is longer than high ; the second and third, or longest spines, slightly exceed the eye in length ; the fourth ray of the second fin is twice the length of the longest spine, the base of the fin measures half the distance between the front edge of the eye and the base of the middle caudal

rays; the anal commences beneath the eighth dorsal ray and extends a little further backwards than the dorsal; the pectoral is very evenly rounded and extends to above the vent, its length is two-thirds that of the head; the ventral is one-sixth shorter

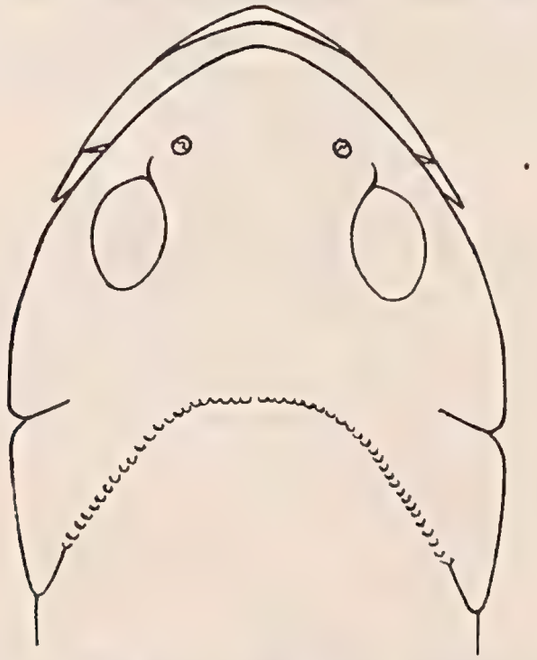

Fig. 15.—*Notothenia coriiceps* var. *macquariensis*.

Upper view of head. Natural size.

than the pectoral, and reaches a point half way between its base and the third anal ray; the caudal is feebly rounded, and the depth of its peduncle is barely twice the diameter of the eye.

Scales.—The head is naked, with the exception of a large patch of scales on the temporal region behind and below the hinder half of the eye and on the upper part of the opercle; the scales below the eye are directed upwards and backwards. The top of the head is covered with granules which are, however, so small as to leave the skin comparatively smooth. The scales on the body are largest along the sides, and are continued some distance up the bases of the pectoral, ventral, and caudal fins. The upper lateral line reaches to below the sixth last ray of the dorsal, and the lower line commences seven scales in advance of the end of the upper one.

Colours.—The general colour is olive grey above and yellow beneath; each scale with a lighter margin; head marbled above and on the sides; body with eight dark bars extending to below the upper lateral line. The first dorsal fin is dusky, darker on the outer half, with a median dark bar; the second dorsal has two or three irregular bars; the other fins are dusky with lighter margins.

Stomach Contents.—Fishes only were found in the stomachs of this species at Macquarie Island, one small victim being readily identified as of *Notothenia macrocephala*.

Length.—400mm. (the second specimen measures 302mm.).

Locality.—This appears to be a rare species at the island, or its haunts were not sufficiently prospected, for after a residence of nearly two years (December 22nd, 1911, to November 28th, 1913), during which period Mr. Hamilton did a considerable amount of fishing with lines and traps, he only secured two examples. During the two visits I paid to Macquarie Island I obtained specimens of *N. macrocephala* in numbers, but did not meet with either *N. coriiceps* or *N. colbecki*.

Having a wide range, this species is subject to considerable variation, and the Macquarie Island specimens exhibit differences which, though not sufficient to invalidate their inclusion with the species, are so marked that the island fishes can at once be detected as different from the Antarctic specimens, the principal differences being as follows:—The mouth is larger and the lips thinner; the preopercle is less oblique; the pectoral is not so long, barely reaching the anal; and the scales extend further up the bases of the paired and caudal fins. This form may be accorded the varietal name of *N. coriiceps* var. *macquariensis*.

Notothenia macrocephala *Günther*.

Notothenia macrocephalus Günther, Cat. Fish. Brit. Mus. ii. 1860, p. 263; Smitt, Bih. Sv. Vet. Akad. Handl. xxiii., 1897, p. 9, pl. iii.

Notothenia maoriensis Haast, Trans. N.Z. Inst. v. 1873, p. 276, pl. xvi., fig. 4.

Notothenia angustata Hutton, Ann. Mag. Nat. Hist. (4) xvi. 1875, p. 315; and Trans. N.Z. Inst. viii. 1876, p. 213.

Notothenia hassleriana Steindachner, Sitzb. Akad. Wiss. Wien, lxxii. 1875, p. 41, pl. vi.

Notothenia antarctica Peters, Monatsb. Akad. Berlin, 1877, p. 837.

Notothenia arguta Hutton, Trans. N.Z. Inst. xi. 1879, p. 339.

Notothenia porteri Delfin, Rev. Chilen. Hist. Nat. iii. 1899, p. 117.

Notothenia macrocephala Regan, Trans. Roy. Soc. Edin. xlix. 1913, p. 277.

(Plate III., fig. 2, and Text fig. 16.)

B. vi.; D. iv. 30; A. 24; V. i. 5; P. 16; C. 13 + 6; L. lat. 40 + 10; Sc. 56; Sc. tr. 8 + 18; Vert. 17 + 29 = 46.

Length of head and height of body, 3·2; and length of caudal, 5·2 in the length; diameter of eye, 6·1; interorbital width, 2·09; and length of snout, 3·7 in that of the head.

The head is as deep as wide; the nostril, in a short tube, lies in a depression nearer the eye than the front of the head, and from it a deep groove passes to the orbit, being overhung by a protuberance which does not, however, extend to the supraciliary region.

The interorbital space is markedly, though evenly, convex, and the rather small eye is well below the profile and almost laterally disposed. The mouth is comparatively horizontal, and the maxilla extends to the first fourth of the orbit; the jaws are equal; no spines on the opercles; all but a narrow portion of the gill membranes is attached to the isthmus; gills four, a long slit behind the fourth; the gill rakers are rather short, feebly spinose, and 17 in number on the first arch, 13 being on the lower limb; pseudobranchiæ present.

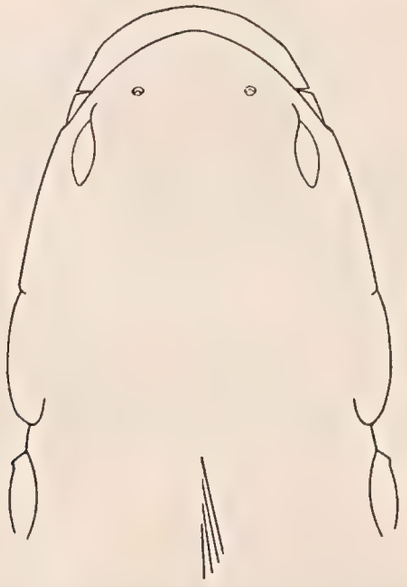

Fig. 16.—*Notothenia macrocephala.*

Upper view of head. Half natural size.

Teeth.—A single row of widely-spaced canines in front, followed by a narrow band of villiform teeth in both jaws. No teeth on vomer, palatines, or tongue.

Fins.—The spinous dorsal originates above a point close behind the opercle; the first spine is the longest, one-half more than the diameter of the eye, and the following three regularly decrease in height. This fin is attached to the base of the first ray by a low membrane. The rays of the second fin increase in height to the fourth, which, with the fifth, are the longest, being one-third longer than the first spine. The base of the soft fin measures half the distance between the tip of the snout and the base of the caudal rays; the anal commences beneath the eighth ray of the dorsal and the two fins are coterminal. The upper pectoral rays are much longer than the lower ones, and the margin is feebly rounded; the fourth, or longest ray, is nearly two-thirds the length of the head, and the fin does not quite reach the vent. The ventral arises beneath the space between the preopercular and opercular margins: its length is two-thirds that of the pectoral. The caudal is subtruncate, and the depth of the peduncle is twice the diameter of the eye.

Scales.—A few isolated scales behind the eye and across the upper part of the opercle; the head is otherwise naked but covered with granules which do not, however,

extend to the snout; the whole of the body is covered with thin cycloid scales, those on the occiput and chest being smallest. The upper lateral line ceases beneath the twenty-fifth dorsal ray, below which point the second line commences; it does not extend on to the base of the caudal.

Colours.—The general colour is olive grey, the lower parts yellow; the markings are black and somewhat irregular, but two oblique bands may be traced below the eye; a branch from the upper one crossing the lower part of the opercle; the rest of the upper parts and sides of the head bear irregular spots and lines; six or seven bands cross the back to below the lateral line, whence they break and form blotches alternating with the bands. The first dorsal fin is dark and clouded; the second has a dark intramarginal band and a white edge; diagonal bars cross the lower portion, and the clouding leaves lacunæ in the membrane; the anal is sooty, but the tips of the rays are lighter; the other fins are also sooty but without markings.

Stomach Contents.—Fish remains. Many specimens of several species of Amphipoda, two species of zoophytes with large gonophores, *? Eucopella*, *? Obelia*, and algæ.

Reproduction.—The ova are very small, developed in considerable quantity, appearing as granules of rosy hue.

Length.—435mm.

Smaller specimens well agree with Steindachner's description and figure, the eye being relatively larger and the pectoral longer than in adults; the concavity in the hinder edge of the caudal, so strongly marked in the young, decreases with age. The type of *N. hassleriana* was 100mm. in length, but we have them as small as 70mm. Small specimens of this species were obtained from the stomachs of *N. coriiceps*, taken at the island.

This species proves to be plentiful and the commonest fish at the island. It is the one illustrated in Sir Douglas Mawson's book * under the title "A good catch of fish at Lusitania Bay." During my visits to the island it was freely caught from the rocks by means of hook and line. The fish trap, set among the kelp, also yielded three examples the only time it was hauled; two of them were small, about 140mm. in length: the remains of the third indicated that it had been quite large, but nothing remained of it but some bones, a fact to be accounted for by the presence of crabs in the trap, the advent of the two smaller fishes being doubtless later, the trap having been down some days prior to hauling.

I also poisoned a large rock pool and secured a number of specimens up to a length of 240mm. Mr. Hamilton also handed me some individuals he had obtained previously to my visit. Small specimens of this species were taken from the stomachs of *N. coriiceps*.

* Mawson, "Home of the Blizzard" ii., 1915, p. 252.

Respecting the plenitude of these fishes, Mr. Ainsworth * writes as follows:—"Hamilton and Blake went out fishing in the dinghy on the 9th and made a remarkable haul of fish, sixty in number, ranging in size from a few ounces to twelve and a half pounds. They were all of the same species, somewhat resembling rock cod, but as usual they were covered with external parasites, and their flesh was full of worm-cysts. Hamilton preserved a number of them and the rest were cooked, but we did not relish them very much, and the one meal was enough." The large fish of "twelve and a half pounds" was preserved, and proves to be *N. colbecki*, the only specimen of the species known from the island, all the other examples being *N. macrocephala*. Mr. Ainsworth has another note on these parasitic worms (*loc. cit.* p. 193):—"Hamilton and Sawyer caught several three-pound fish on April 2nd . . . . They were good eating, but, unfortunately, were very much worm-infested. These parasitical worms are about an inch and a half long and taper to a point at each end. They penetrate right through the flesh and are plainly noticeable after the fish is cooked. One has to dodge the worms as the meal proceeds; either that or persuade oneself that they do not matter."

Parasites of allied, if not identical, genera appear to infest all the Notothenias of the Subantarctic islands, or at any rate those grouped southward of Australia and New Zealand. I have taken them also from *N. microlepidota* at the Snares and the Auckland Islands, and from *N. colbecki*, at Antipodes Island. The fluke-like parasites which glided over the body of the last-named species were identified by Prof. Benham as species of *Tristoma*.†

Distribution.—*N. macrocephala* is found in the coastal areas of the Magellan and Antipodes Districts, also at Kerguelen Island.‡ There is no Subantarctic land in the Pacific Zonal Quadrant, but in the south temperate zone (which this species also affects in Chili and New Zealand) it enters the Quadrant at the Chatham Islands, according to Mr. Regan's map.§ It may be, however, that the "w" there indicating this species should have been placed in the Australian Zonal Quadrant at Lyttelton, where it is known to occur. At Kerguelen it enters the African Zonal Quadrant.

Notothenia microlepidota *Hutton.*

Notothenia microlepidota Hutton, Trans. N.Z. Inst. viii. 1876, p. 213; Waite, Subantarctic Islands of N.Z. ii. 1909, p. 590, fig. 24.

Notothenia parva Hutton, Trans. N.Z. Inst. xi. 1879, p. 339.

Taken at the Auckland Islands, where it was previously known to be common.

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* Ainsworth, in Mawson's "Home of the Blizzard," ii. 1915, p. 235.

† Waite, Subantarctic Is. of N.Z. ii. 1909, p. 594.

‡ In this connection Mr. Regan writes to me under date June 24th, 1915:—"To the published list of Kerguelen Island fishes I should have added *Notothenia macrocephala*. Peters described it from the island as *N. antarctica*, and there are two very small examples taken by the 'Challenger' at Kerguelen, hitherto undetermined, which I refer to this species."

§ Regan, Brit. Antarct. Exped. ("Terra Nova"), 1910, i. 1914, p. 31.

Notothenia colbecki *Boulenger.*

Notothenia colbecki Boulenger, Rep. "Southern Cross," 1902, p. 185, pl. xvi.; Waite, Subantarctic Is. N.Z. ii, 1909, p. 594; Regan, Trans. Roy. Soc. Edin. xlix., 1913, p. 278.

The only example preserved was caught by Mr. Hamilton with the hook amongst kelp. He remarks that it is the largest *Notothenia* taken, and is of quite exceptional size, weighing 12½lbs. when freshly caught. The species was previously known from the Antipodes, Auckland, and Campbell Islands, and the largest specimen hitherto actually identified measured 550mm. in length. The Macquarie Island example is larger, measuring 685mm.: the remains of a specimen, taken at the winter quarters of the "Discovery" and regarded by Mr. Boulenger as probably of this species, indicates that it grows to a gigantic size.*

Stomach Contents.—The stomach contained remains of fishes too far digested to be determined, and a large isopod, together with a considerable quantity of green algæ.

Reproduction.—The ova, developed in great number, are extremely minute and of greyish pink colour.

As mentioned elsewhere (pp. 6, 69), this species is subject, in common with other members of the genus, to the presence of both external parasites and muscle worms, nearly every example taken at the Antipodes Island being so infested.

HARPAGIFER Richardson.

Harpagifer bispinis *Forster.*

Callionymus bispinis Forster, in Bloch and Schneider, Syst. Ichth. 1801, p. 45.

Harpagifer bispinis Richardson, Voy. "Ereb." and "Terr.," 1844, p. 11, and 1845, p. 19, pl. vii., figs. 1-3, and pl. xii., 8, 9; Pappenheim, Deutsche Südpolar Exped. 1901-3, xiii. Fische, 1912, p. 177, pl. ix., fig. 5.

Harpagifer palliolatus Richardson, *loc. cit.* 1845, p. 20, pl. xii., figs. 5-7.

During my visit to Macquarie Island in June, 1912, I poisoned some rock pools and obtained many examples of this fish. On the occasion of my second visit in the following year, Mr. H. Hamilton handed me a further lot which he had obtained by similar means. The known range of this monotypic genus is now so extended as to show that its distribution is almost circumpolar, the absence of land in the Subantarctic region of the Pacific Zonal Quadrant accounting for its absence there. *Harpagifer* is known from Patagonia, Terra del Fuego, Magellan Strait, Graham Land, Falkland Islands,

* Boulenger, Nat. Antarct. Exped. ii., 1907, Fishes, p. 1.

South Georgia, and South Orkneys in the American Zonal Quadrant, and from the Marion Islands and Kerguelen in the African Zonal Quadrant. It is now definitely recorded from the Australian Zonal Quadrant at Macquarie Island.

Mr. Augustus Hamilton, who wrote a paper entitled "Notes on a visit to Macquarie Island," briefly refers to the fishes as follows :—* "In the tidal pools at low water some small gobies were found which have not yet been examined critically, but I think one of the two species is *Harpagifer bispinis*, also found at Kerguelen. A good sized fish was obtained by fishing with a hook from one of the rocks, and specimens were preserved but have not come to hand; and two small specimens were picked up on the beach of a small sprat-like fish."

It is interesting to be able to confirm the suspected identity of *Harpagifer*, and there can be little doubt that the fish taken on the line was a *Notothenia*, possibly *N. macrocephala*.

The stomach contents of the specimens have been determined by Mr. Whitelegge as species of Amphipoda and Isopoda. Small univalve shells were also present.

Family BLENNIIDÆ.

TRIPTERYGION Risso, 1826.

Tripterygion varium *Forster*.

Blennius varius Forster, in Bloch and Schneider, Syst. Ichth. 1801, p. 178.

Tripterygion varium Cuvier and Valenciennes, Hist. Nat. Poiss. xi. 1836, p. 414; Waite, Pisces "Subantarctic Is. N.Z." ii. 1909, p. 597, and Rec. Cant. Mus. ii. 1913, p. 7, pl. iii.

Tripterygion nigripenne Cuvier and Valenciennes, *loc. cit.* p. 413, pl. cccxxxix.

Tripterygion capito Jenyns, Fishes, Voy. "Beagle," 1841, p. 94, pl. xix., fig. 1.

Trypterygium forsteri Hutton, Trans. N.Z. Inst. v. 1873, p. 263.

Trypterygium fenestratum Hutton, *loc. cit.*

Trypterigium robustum Clarke, *ib.* xi. 1879, p. 292, pl. xv.

Tripterygium jenningsi Hutton, *loc. cit.* xi. 1879, p. 339.

Taken under stones at Figure-of-Eight Island, Carnley Harbour, Auckland Islands, from which group it has been known since 1879 (*T. jenningsi*).

* Hamilton, Trans. N.Z. Inst. xxvii. 1895, p. 577, *et seq.*

Family SCORPÆNIDÆ.

ZANCLORHYNCHUS Gunther, 1880.

Zanclorhynchus spinifer *Günther.*

Zanclorhynchus spinifer Günther, Chall. Rep. i. 1880, p. 15, pl. viii., fig. A.

B. vii. ; D. viii.-ix., 14-15 ; A. 11 ; P. 9 ; V. i. 5 ; C. 10 + 8 ; L. lat. 11-12.

Length of head, 2·8 ; height of body, 3·2 ; and length of caudal, 3·9 in the length ; diameter of eye, 4·2 ; interorbital space, 6·8 ; and length of snout, 2·6 in the head.

The head is compressed, the occiput flat, but rising to the dorsal fin ; the interorbital space is concave ; the nostril lies in front of the eye, slightly below its median height ; the mouth is small but very protractile with thick reverted lips ; the maxilla does not reach to the line of the nostril ; gill slit restricted, extending from the upper angle of the opercle to above the base of the pectoral.

The disposition of the spines on the head is as follows :—One above the nostril and a minute one below it ; one in continuation of the supraorbital ridge ; two above the preopercle, of which the anterior one is small ; and a very large one above the opercle with an auxiliary prong, like an antler ; one on the cheek below the hinder half of the eye ; and one on each side immediately in front of the first dorsal spine. There is also a large spine on the body above the base of the pectoral fin.

The body is compressed and naked, but its greater part is covered with minute asperities, the base of the first dorsal fin being naked ; the lower portions, from below the origin of the lateral line to the vent and along the base of the anal fin to the caudal are devoid of asperities, but the skin is closely wrinkled.

Teeth.—Extremely minute teeth are present in the jaws and on the vomer.

Fins.—The dorsal fin commences behind the occiput, the first spine is as long as, the second twice, and the third, or longest, thrice the diameter of the eye ; they are all roughened in front. The following regularly decrease in length, but when depressed the third and following spines reach the same point, which lies midway between the tip of the snout and the end of the caudal. The two fins are connected by a low membrane ; the base of the second fin is two-thirds the length of the first ; its longest rays are half that of the third spine ; the anal has a shorter base, but its fourth and fifth rays are longer than the corresponding ones of the dorsal. The pectoral is pointed, its fourth lowest ray is nearly as long as the head, and extends to the point attained by the adpressed dorsal spines. The ventrals are large, the middle rays reaching the anal ; they lie midway between that fin and the pectorals. The caudal is truncate, the depth of the peduncle equals its length ; the rays of all the fin are undivided.

Lateral Line.—The lateral line commences on a level with the base of the opercular spine and passes straight to the middle of the caudal peduncle; it is formed of 11 or 12 elongated elevations, many of which bear a minute spine.

Colours.—Body purplish, merging into yellow behind; a dark blotch below the three first dorsal spines and an irregular bar below the spinous fin; another below the soft portion; and a third across the caudal peduncle. The fins are yellow, each with a broad dark bar, excepting the first dorsal, the hinder portion of which bears a dark blotch.

Stomach Contents.—Prof. Haswell has found among the material recovered from these specimens many remains of Amphipods and one *Priapulus*.

Reproduction.—The ova are small, 0·8mm. in diameter, and yellow in colour.

Length.—202mm. A second specimen in which the spines are blunted by wear, denoting an adult or aged condition, is larger, and measures 238mm. in length.

Locality.—The two specimens were handed to me at Macquarie Island by Mr. Hamilton, who caught them on a line at the northern end of the island, in eight fathoms. He told me that they were often seen swimming about in the kelp but were difficult to catch.

Remarks.—These fishes appear to constitute the second occasion on which the species has been obtained. The type represented by a single example, trawled by the "Challenger" off Kerguelen Island, was much smaller, being 3½in. (90mm.) long. The immaturity of the type will well account for the statement that the mouth is toothless, and, perhaps, also for the non-mention of certain small spines on the head, namely, that below the nostril, the second on the preopercle, and the pair in front of the first spine of the dorsal fin. No mention is made of the auxiliary prong on the opercular spine. Abrasion has extended so far in my larger example that the opercular spine is worn down below the point whence the prong originates.

3 AUSTRALASIA.

With the exception of *Myctophum antarcticum* and *Nematonurus armatus*, the following fishes were taken on the summer Subantarctic cruise, 1912. No *data* accompanied the specimens, but they were probably taken on December 12th, when successful trawlings were made in 75 and 1,300 fathoms. Captain Davis states that from the deeper trawling "a large octopus and several interesting fish were obtained." It is, however, improbable that any of the fishes submitted, excepting *Antimora*, are from the greater depth, all the others being well known from under 100 fathoms.

Myctophum antarcticum Günther
Chlorophthalmus nigripinnis Günther
Notopogon lilliei Regan
Cœlorhynchus australis Richardson
Nematonurus armatus Hector
Antimora viola Goode and Bean
Physiculus barbatus Günther
Zanclistius elevatus Ramsay and Ogilby
Scorpæna percoides Richardson
Lepidotrigla modesta Waite
Parapercis allporti Günther

Family MYCTOPHIDÆ.

MYCTOPHUM Rafinesque, 1810.

Myctophum antarcticum *Günther.*

(For synonymy see page 59, pl. iv.)

Six examples were taken in the tow net, south-west of Tasmania, in Lat. 45° 0′ S., Long. 138° 0′ E.

Family SUDIDÆ.

CHLOROPHTHALMUS Bonaparte, 1840.

Chlorophthalmus nigripinnis *Günther.*

Chlorophthalmus nigripinnis Günther, Ann. Mag. Nat. Hist. (5), ii. 1878, p. 182; and Chall. Rep. xxii. 1887, p. 193, pl. li., fig. A. Waite, Mem. Aust. Mus. iv. 1899, p. 54, fig. 4, and Rec. Cant. Mus. i. 1911, p. 164, pl. xxv.

Twelve specimens were taken in 75 fathoms off the east coast of Tasmania. This species is also known from Victoria, New South Wales, and New Zealand seas.

Family MACRORHAMPHOSIDÆ.

NOTOPOGON Regan, 1914.

Notopogon lilliei *Regan.*

Centriscops humerosus Waite, Rec. Cant. Mus. i., June, 1911, p. 169; McCulloch, "Endeavour" Sci. Res. i., Dec. 1911, p. 24, fig. 9, and pl. v.

Notopogon lilliei Regan, Ann. Mag. Nat. Hist. (8) xiii. 1914, pp. 14, 20; and Brit. Antarct. Exped. ("Terra Nova"), 1910, i. 1914, p. 15, pl. xii., fig. 4; McCulloch, "Endeavour" Sci. Res. ii. 1914, p. 91.

Three specimens were secured in 75 fathoms off the east coast of Tasmania where, however, it was previously known to occur.

The name *Centriscops cristatus* has crept into Mr. McCulloch's last-quoted paper (p. 93), but I believe that this was a manuscript name, intended to designate the species which Mr. Regan named as above, in which case it should not appear further in literature.

Family MACROURIDÆ.

CŒLORHYNCHUS Giorna, 1803.

Cœlorhynchus australis *Richardson.*

Lepidoleprus australis Richardson, Proc. Zool. Soc. 1839, p. 100.

Macrurus australis Günther, Cat. Fish. Brit. Mus. iv. 1862, p. 391.

Cœlorhynchus mortoni Ogilby, Proc. Roy. Soc. Tasm. 1897, p. 83.

Cœlorhynchus australis Waite, Rec. Cant. Mus. i. 1911, p. 177, pl. xxix., fig. 1.

Two specimens obtained off the east coast of Tasmania; the species was previously known from this locality. Of the two stations recorded they were probably taken at 75 fathoms; 1,300 fathoms, the depth of the second station, being considerably beyond the known limits of the species.

Reproduction.—The ova are of different sizes, suggesting that they do not all ripen together; they are yellow in colour; and the largest measures 1mm. in diameter.

NEMATONURUS Gunther, 1887.

Nematonurus armatus *Hector.*

Macrurus armatus Hector, Ann. Mag. Nat. Hist. (4) xv. 1875, p. 81; and Trans. N.Z. Inst. vii. 1875, p. 249, pl. xi., fig. 78A.

Coryphænoides variabilis Günther, Ann. Mag. Nat. Hist. (5) ii. 1878, p. 27.

Nematonurus armatus Günther, Chall., Rep. xxii. 1887, p. 150, pl. xl., fig. A.

A single specimen of this well-known species was taken on February 24th, 1914, in Lat. 35° 55′ S., Long. 134° 18′ E., in 1,800 fathoms, about 140 miles west of Kangaroo Island, South Australia, on the final return of the "Aurora" from the Antarctic. This is the specimen described to me as a "large white fish, taken in deep water." It proves to be of the variety described by Günther as "a kind of albino, not quite white, but of a much lighter colour than the ordinary specimens." A note attached to the specimen by Mr. Hunter reads as follows:—"Pinkish above, paler below, operculum with bluish streaks." Of many examples hitherto obtained at different times, the largest seems to be 558mm. in length; but our specimen is much longer, being 805mm.

One of the "Challenger" specimens was taken south of Australia.

Stomach Contents.—The mass of the contents of the specimen obtained off South Australia consisted of remains of Cephalopods, the beaks only showing definite structure; the jaws of an Echinoid were also recovered.

Family GADIDÆ.

ANTIMORA Günther, 1878.

Antimora viola *Goode and Bean.*

Haloporphyrus viola Goode and Bean, Proc. U.S. Nat. Mus. i. 1879, p. 257.

Antimora viola Günther, Chall. Rep. xxii. 1887, p. 94, pl. xv.

Associated with this species is a single mutilated specimen taken during the second Subantarctic cruise of the "Aurora," 25 miles off Tasmania, in 1,300 fathoms. The available portion consists of the head and body to the beginning of the anal fin; but all the scales and most of the rays have been lost.

Three species of the genus have been described, namely:—

A. rostrata Günther, 1878.

A. viola Goode and Bean, 1879.

A. microlepis T. H. Bean, 1890.

A. rostrata was taken from between the Cape of Good Hope and Kerguelen Island, near Marion Island, and off Monte Video.

A. viola and *A. microlepis* were obtained from the North Atlantic.

All three species are apparently allied, and one would naturally seek affinity with *A. rostrata* on account of similarity in geographical position. The sum of the available characters, however, indicates association with *A. viola*, the figures published by Günther well portraying our specimen.

The wide distribution of deep sea species is a well known fact, and another Gadioid, *Melanonus gracilis* Günther, has similarly been taken in the North Atlantic and Antarctic Oceans.

PHYSICULUS Kaup, 1858.

Physiculus barbatus *Günther.*

Pseudophycis barbatus Günther, Ann. Mag. Nat. Hist. (3) xi. 1863, p. 116; McCoy, Prod. Zool. Vict. 1878, p. 29, pl. xx.

Physiculus palmatus Klunzinger, Arch. für Naturg. xxxviii. 1872, p. 38.

Lotella grandis Ramsay, Proc. Linn. Soc. N.S.W. v. 1881, p. 462.

Physiculus barbatus Waite, Mem. N.S.W. Nat. Club, ii. 1904, p. 24.

Two specimens from off the east coast of Tasmania from, presumably, 75 fathoms.

Family BOVICHTHYIDÆ.

BOVICHTHYS Cuvier and Valenciennes, 1831.

Bovichthys variegatus *Richardson.*

Bovichthys variegatus Richardson, Voy. "Ereb." and "Terr." 1846, p. 56, pl. xxxiv.

Bovichiths roseo-pictus Hutton, Trans. N.Z. Inst. xxxvi. 1904, p. 148.

Previously known from the Auckland Islands, this species was taken in rock pools on Enderby Island, one of the group.

The name *Bovichthys* is accepted as a correction of *Bovichtus*, the original spelling of the genus.

Family HISTIOPTERIDÆ.

ZANCLISTIUS Jordan, 1907.

Zanclistius elevatus *Ramsay and Ogilby.*

Histiopterus elevatus Ramsay and Ogilby, Proc. Linn. Soc. N.S.W. (2) iii. 1888, p. 1311; Waite, Mem. Aust. Mus. iv. 1899, p. 114, pl. xxvi.

Zanclistius elevatus Jordan, Proc. U.S. Nat. Mus. xxxii. 1907, p. 236; McCulloch, "Endeavour" Sci. Results, i. 1911, p. 67, figs. 14-18.

Three specimens were obtained off the east coast of Tasmania in, presumably, 75 fathoms. In the paper above quoted, McCulloch has amply illustrated the variations which take place in the contour of this species during its growth. He has also shown that similar changes occur in respect to *Maccullochia labiosa* Günther.

Family SCORPÆNIDÆ.

SCORPÆNA Linnæus, 1758.

Scorpæna percoides *Richardson.*

Sebastes percoides Richardson, Ann. Mag. Nat. Hist. (1) ix. 1842, p. 384; and Voy. "Ereb." and "Terr." 1845, p. 23, pl. xv.; McCoy, Prod. Zool. Vict. i. 1879, pl. xxxiii.

Scorpæna barathri Hector, Trans. N.Z. Inst. vii. 1875, p. 245.

Sebastapistes percoides Waite, Mem. Aust. Mus. iv. 1899, p. 100.

Scorpæna (*Helicolenus*) *percoides* McCulloch, Rec. Aust. Mus. vi. 1907, p. 350.

Scorpæna percoides Waite, Rec. Cant. Mus. i. 1911, p. 249.

Helicolenus percoides McCulloch, "Endeavour" Sci. Res. iii. 1915, p. 158.

Thirty examples were taken in 75 fathoms, off the east coast of Tasmania. The species is common in Tasmanian and Southern Australian waters, and is also found on the coast of New South Wales, becoming scarcer northwards.

The generic status of the species has proved the subject of some uncertainty. Mr. McCulloch, in the paper first quoted above, remarked that *Helicolenus* is a genus doubtfully distinct from *Scorpæna;* but in the second paper adopts the name without comment. Reversion to *Scorpæna* is not to be taken as any definite pronouncement on the subject, rather that the question is still undecided.

Mr. McCulloch mentions that a female taken on the "Woy Woy" contained unripe ova. In my New Zealand paper above listed I remarked that "In common with many other Sebastoid fishes, this species is viviparous."

Family TRIGLIDÆ.

LEPIDOTRIGLA Günther, 1860.

Lepidotrigla modesta *Waite.*

Lepidotrigla modesta Waite, Mem. Aust. Mus. iv. 1899, p. 106, pl. xxiii.

Eighteen specimens were preserved from the takings off the east coast of Tasmania in 75 fathoms. The species was originally described from examples taken off the coast of New South Wales, and has not, I believe, been again recognised until now.

Family LEPTOSCOPIDÆ.

PARAPERCIS Bleeker, 1864.

Parapercis allporti *Günther.*

Percis allporti Günther, Ann. Mag. Nat. Hist. (4) xvii. 1876, p. 394.

Parapercis ocularis Waite, Mem. Aust. Mus. iv. 1899, p. 109, pl. xxiv.

Parapercis allporti McCulloch, "Endeavour" Sci. Res. ii. 1914, p. 157.

A single example taken off the east coast of Tasmania in 75 fathoms, from similar locality whence it was obtained by the "Endeavour." The publication of the results of this ill-fated trawler are here quoted as "Scientific Results"; but it may be noted that different parts dealing with the fishes appear under the titles "Zoological Results," "Biological Results," and "Scientific Results."

ADDENDUM.

After the proofs of the foregoing had been passed for printing off, I received from Mr. C. Tate Regan his second paper on the fishes of the "Terra Nova" Expedition, entitled "Larval and Post-larval Fishes."* This masterly paper demonstrates how the possession of knowledge, coupled with method and patience, may be the means of identifying larval forms that give little indication of their ultimate character. By counting the myotomes, fin-rays, and vertebræ, and noting other structures, generic and even specific determinations have been made. Not the least interesting portion of the paper is that devoted to "Notes and Conclusions." Many valuable inferences are deduced from study of the larval forms; of special interest being the statement that the larvæ of some deep-water species have an extended pelagic existence, and may travel long distances before assuming the adult state. It is also inferred that certain coastal fishes owe their wide dispersal to the oceanic habit of their young, which habit is relinquished as growth proceeds.

The status of the fishes of the Australasian Antarctic Expedition is not specially affected by Mr. Regan's latest publication, but the following species included in his paper may be briefly noticed:—

PARALIPARIS TERRÆ NOVÆ *Regan*.

"Larval and Post-larval Fishes," p. 129, pl. i., fig. 6.

This new species differs more from *P. antarcticus* than does *P. wildi*, possessing fewer fin-rays, and having no elongate lower rays in the pectoral. Three species are now known from Antarctica.

SARDINA NEOPILCHARDUS *Steindachner*.

"Larval and Post-larval Fishes," p. 136, pl. v., figs. 3 and 4. Australasian Antarctic Expedition Report, p. 56.

The name *Sardina*, though commonly used for the European Pilchard, does not appear in the various Nomenclatores, and I am unaware of its author and date of publication. If earlier than 1849 it must take precedence of *Amblygaster* used in my paper.

* Regan, Brit. Antarct. Exped. ("Terra Nova"), 1910, i. 1916, pp. 125-156, pls. i.-x.

Leptocephalus.

"Larval and Post-larval Fishes," p. 140. Australasian Antarctic Expedition Report, p. 13.

Mr. Regan uses this name "as a generic term for larval Eels." Under the impression that *Leptocephalus* had been definitely associated with the Conger Eels, I followed Garman in employing the name *Atopichthys* for unidentified larval forms.

Limnichthys fasciatus *Waite.*

"Larval and Post-larval Fishes," p. 143, fig. 4.

Among the collections made off the northern islands of New Zealand by my friends Mr. D. G. Lillie and the late Lieutenant Pennell,* are specimens of this little species originally described from examples taken in rock pools on Lord Howe Island. Mr. Regan notes that it was also recorded from pools near Sydney, and reports its occurrence from off the Three Kings Islands, north of New Zealand. The little wanderer has, however, an even wider distribution, having been taken at the Kermadec Islands,† and more recently from rock pools on Norfolk Island, being included in a collection made thereat by Mr. A. M. Lea, Entomologist to the South Australian Museum. Mr. Regan mentions that Lord Howe Island is distant 600 miles from the coast of New South Wales; its nearest point to the mainland is Port Macquarie, 300 miles distant; while its distance from Norfolk Island is about 500 miles.

* Commander Harry L. L. Pennell, R.N., is reported to have lost his life in the Naval engagement off the Skager-rack on May 31st.

† Waite. Trans. N.Z. Inst. xlii. 1910, p. 379.

EXPLANATION OF PLATES, ETC.

MAP I.

Collecting Stations of the "Aurora," 1912-1914.

MAP II.

Subantarctic Cruises of the "Aurora" and "Tutanekai," 1912-1913.

PLATE I.

Fig. 1—Austrolycichthys brachycephalus *Pappenheim.*
Nat. size. Station X. Shackleton Ice-shelf; 320 fathoms.

Fig. 2—Dolloidraco longedorsalis *Roule.*
Nat. size. Station X. Shackleton Ice-shelf; 325 fathoms.

Fig. 3—Bathydraco nudiceps *Waite.*
Nat. size. Station IX. Shackleton Ice-shelf; 240 fathoms.

PLATE II.

Fig. 1—Aconichthys harrissoni *Waite.*
14/15 nat. size. Station X. Shackleton Ice-shelf; 325 fathoms.

Fig. 2—Dacodraco hunteri *Waite.*
Nat. size. Station XI. Shackleton Ice-shelf; 325 fathoms.

PLATE III.

Fig. 1—Cygnodraco mawsoni *Waite.*
6/7 nat. size. Station VII. Drygalski Island; 60 fathoms

Fig. 2—Notothenia macrocephala *Günther.*
12/13 nat. size. Macquarie Island.

Plate IV.

Fig. 1—Paraliparis wildi *Waite.*

Nat. size. Station X. Shackleton Ice-shelf; 325 fathoms.

Fig. 2—Myctophum antarcticum *Günther.*

Twice nat. size. Surface between Macquarie and Auckland Islands.

Fig. 3—Aurion effulgens *Waite.*

Twice nat. size. Surface, S.W. of Adams Island, Auckland group.

Plate V.

Fig. 1—Idiacanthus aurora *Waite.*

1/2 nat. size. 25 miles north of Macquarie Island; 636-1,450 fathoms.

Fig. 2—Notosudis hamiltoni *Waite.*

2/5 nat. size. Macquarie Island beach.

Fig. 3—Notothenia coriiceps *Richardson* var. macquariensis *Waite.*

5/8 nat. size. Macquarie Island.

INDEX.

PAGE.

ACONICHTHYS 30
harrissoni 6, 10, 12, 30, 32
acuta NOTOTHENIA 46, 50
allporti PARAPERCIS 74, 79
PERCIS 79
AMBLYGASTER 56, 81
neopilchardus 46, 49, 56, 81
americanus POLYPRION 55
ANGUILLA aucklandii 46, 49
australis 45, 46, 49
angustata NOTOTHENIA 66
antarctica NOTOTHENIA 66, 69
antarcticum MYCTOPHUM 45, 46, 47, 49, 59, 61, 74
PLEURAGRAMMA 10, 12, 15, 22
antarcticus BATHYDRACO 28, 29
CRYODRACO 10, 11, 15, 39, 40
LYCODICHTHYS 10, 11, 14, 15
PAGETODES 40
PARALIPARIS 44, 81
SCOPELUS 59
ANTIMORA 74, 76
microlepis 76, 77
rostrata 76, 77
viola 74, 76, 77
antrostomus IDIACANTHUS 54, 55
arguta NOTOTHENIA 66
armatus MACRURUS 76
NEMATONURUS 74, 76
ARTEDIDRACO 23, 24, 25
lonbergi 24
mirus 24
orianæ 24
shackletoni 10, 11, 23, 24
skottsbergi 23, 24
atkinsoni CRYODRACO 39, 40
atlanticus IDIACANTHUS 54, 55
ATOPICHTHYS 10, 13, 82
attenuatus GALAXIAS 46, 49
aucklandii ANGUILLA 46, 49
AURION 62
effulgens 46, 50, 63
aurora IDIACANTHUS 45, 49, 53, 54, 55

PAGE.
australis ANGUILLA 45, 46, 49
CŒLORHYNCHUS 74, 75
GERLACHEA 10, 12, 29
LEPIDOLEPRUS 75
MACRURUS 75
AUSTROLYCICHTHYS 9, 15
brachycephalus 10, 11, 12, 15

barathri SCORPÆNA 78
barbatus PHYSICULUS 74, 77
PSEUDOPHYCIS 77
bathybii PARALIPARIS 44
BATHYDRACO 27, 29, 30, 63
antarcticus 28, 29
macrolepis 28
nudiceps 10, 12, 27, 29
scotiæ 28
BATHYDRACONIDÆ 27, 34, 63
BATHYOPHIS ferox 54
BENTHOSOMUS colletti 59
bernacchii TREMATOMUS 10, 11, 19
bispinatus EUPROTOMICRUS 46, 49
bispinis CALLIONYMUS 70
HARPAGIFER 45, 46, 47, 50, 70, 71
blainvillianus SYNGNATHUS 46, 49
BLENNIIDÆ 71
BLENNIUS varius 71
BOVICHTHYIDÆ 62, 77
BOVICHTHYS 62, 77
roseo-pictus 77
variegatus 46, 49, 63, 77
brachycephalus AUSTROLYCICHTHYS 10, 11, 12, 15
LYCODES 15
braueri LAMPANYCTUS 45, 47, 49, 61
MYCTOPHUM 61
brevipinnis GALAXIAS 46, 49

CALLIONYMUS bispinis 70
capito TRIPTERYGION 71
CENTRISCOPS cristatus 75
humerosus 75
centronotus TREMATOMUS 10, 11, 12, 21
CENTROSCYMNUS 51, 52
CHÆNICHTHYIDÆ 34, 35, 47, 63
CHÆNICHTHYS rhinoceratus 46, 50
rugosus 46, 50
CHÆNOCEPHALUS 40
CHALINURA 9, 13
ferrieri 10, 11, 13
whitsoni 10, 11, 14

PAGE.
CHAMPSOCEPHALUS 38
macropterus 37
CHIONODRACO 41
kathleenæ 10, 11, 12, 41
CHLOROPHTHALMUS 74
nigripinnis 74
CLUPANODON neopilchardus 56
CLUPEIDÆ 56
CLUPEA neopilchardus 56
CŒLORHYNCHUS 75
australis 74, 75
mortoni 75
colbecki NOTOTHENIA 6, 45, 46, 47, 50, 66, 69, 70
colletti BENTHOSOMUS 59
GEOPELUS 59
SCOPELUS 59
CONGIOPODUS 47
coriiceps NOTOTHENIA 10, 11, 22, 45, 46, 47, 50, 64, 66, 68
CORYPHÆNOIDES variabilis 76
cristatus CENTRISCOPS 75
CRYODRACO 39, 40, 63
antarcticus 10, 11, 15, 39, 40
atkinsoni 39, 40
pappenheimi 40
cyaneobrancha NOTOTHENIA 18, 46, 50
CYCLOPTERIDÆ 43
CYGNODRACO 32
mawsoni 10, 11, 33

DACODRACO 35
hunteri 6, 10, 12, 36
DOLLOIDRACO 24
longedorsalis 6, 10, 12, 24, 26

eatoni RAIA 46, 49
ECHINORHINIDÆ 51
effulgens AURION 46, 50, 63
elegans NOTOTHENIA 19
elevatus HISTIOPTERUS 78
ZANCLISTIUS 74, 78
ETMOPTERUS 52
eulepidotus TREMATOMUS 10, 11, 12, 21, 22
EUPROTOMICRUS 52
bispinatus 46, 49
evansii PRIONODRACO 10, 11, 12, 35

fasciatus GALAXIAS 46, 49
LIMNICHTHYS 82
fasciola IDIACANTHUS 54, 55
fenestratum TRYPTERYGIUM 71

PAGE.
ferox BATHYOPHIS 54
IDIACANTHUS 54, 55
ferrieri CHALINURA 10, 11, 13
filholi NOTOTHENIA 46, 50
forsteri TRYPTERYGIUM 71
GADIDÆ 76
GALAXIAS attenuatus 46, 49
brevipinnis 46, 49
fasciatus 46, 49
GEOPELUS colletti 59
georgianus TREMATOMUS 19
GERLACHEA 29, 30, 63
australis 10, 12, 29
gracilis MELANONUS 77
grandis LOTELLA 77
GYMNODRACO 30, 32
HALOPORPHYRUS viola 76
hamiltoni NOTOSUDIS 45, 49, 57
hansoni TREMATOMUS 10, 12, 19, 20
HARPAGIFER 48, 70, 71
bispinis 45, 46, 47, 50, 70, 71
palliolatus 70
harrissoni ACONICHTHYS 6, 10, 12, 30, 32
hassleriana NOTOTHENIA 66, 68
HELICOLENUS 78
percoides 78
HETEROSCYMNUS 52
HISTIOPTERIDÆ 78
HISTIOPTERUS elevatus 78
hodgsoni NOTOTHENIA 18
humerosus CENTRISCOPS 75
hunteri DACODRACO 6, 10, 12, 36
IDIACANTHUS 47, 53
antrostomus 54, 55
atlanticus 54, 55
aurora 45, 49, 53, 54, 55
fasciola 54, 55
ferox 54, 55
niger 54, 55
ISISTIUS 52
jenningsi TRIPTERYGIUM 71
kathleenæ CHIONODRACO 10, 11, 12, 41
labiosa MACCULLOCHIA 78
LAMPANYCTUS 61
braueri 45, 47, 49, 61
LEPIDOLEPRUS australis 75
lepidorhinus NOTOTHENIA 19
TREMATOMUS 21

PAGE.
LEPIDOTRIGLA 79
modesta 74, 79
LEPTOCEPHALUS 82
LEPTOSCOPIDÆ 79
lilliei NOTOPOGON 74, 75
LIMNICHTHYS fasciatus 82
loennbergii TREMATOMUS 10, 11, 12, 20
lonbergi ARTEDIDRACO 24
longedorsalis DOLLOIDRACO 6, 10, 12, 24, 26
LOTELLA grandis 77
LYCODES brachycephalus 15
LYCODICHTHYS 9, 14
antarcticus 10, 11, 14, 15
MACCULLOCHIA labiosa 78
macquariensis NOTOTHENIA 64, 66
macrocephala NOTOTHENIA 6, 45, 46, 47, 48, 50, 65, 66, 69, 71
macrolepis BATHYDRACO 28
macropterus CHAMSOCEPHALUS 37
PAGETOPSIS 10, 11, 12, 15, 37, 39
MACRORHAMPHOSIDÆ 75
MACROURIDÆ 13, 75
MACRURUS armatus 76
australis 75
maoriensis NOTOTHENIA 66
marmoratus MURŒNOLEPIS 46, 49
mawsoni CYGNODRACO 10, 11, 33
MELANONUS gracilis 77
microlepidota NOTOTHENIA 6, 18, 46, 50, 69
microlepis ANTIMORA 76, 77
mirus ARTEDIDRACO 24
mizops NOTOTHENIA 46, 50
modesta LEPIDOTRIGLA 74, 79
mortoni CŒLORHYNCHUS 75
MURŒNOLEPIS marmoratus 46, 49
murrayi RAIA 46, 49
MYCTOPHIDÆ 59, 74
MYCTOPHUM 59, 61, 74
antarcticum 45, 46, 47, 49, 59, 61, 74
braueri 61
NEMATONURUS 76
armatus 74, 76
neopilchardus AMBLYGASTER 46, 49, 56, 81
CLUPANODON 56
CLUPEA 56
SARDINA 81
NEOSCOPELUS 61
newnesi TREMATOMUS 10, 11, 18
nicolai NOTOTHENIA 18
TREMATOMUS 10, 12, 18

PAGE.
niger IDIACANTHUS 54, 55
nigripenne TRIPTERYGIUM 71
nigripinnis CHLOROPHTHALMUS 74
NOTOLEPIS 47
NOTOPOGON 75
lilliei 74, 75
NOTOSUDIS 47, 56
hamiltoni 45, 49, 57
NOTOTHENIA 6, 19, 22, 48, 64, 70, 71
acuta 46, 50
angustata 66
antarctica 66, 69
arguta 66
colbecki 6, 45, 46, 47, 50, 66, 69, 70
coriiceps 10, 11, 22, 45, 46, 47, 50, 64, 66, 68
cyaneobrancha 18, 46, 50
elegans 19
filholi 46, 50
hassleriana 66, 68
hodgsoni 18
lepidorhinus 19
macquariensis 64, 66
macrocephala 6, 45, 46, 47, 48, 50, 65, 66, 69, 71
maoriensis 66
microlepidota 6, 18, 46, 50, 69
mizops 46, 50
nicolai 18
parva 69
porteri 66
scotti 21
sima 19
squamifrons 46, 50
NOTOTHENIIDÆ 18, 34, 64
nudiceps BATHYDRACO 10, 12, 27, 29
NYCTOPHUS 61

ocularis PARAPERCIS 79
orianæ ARTEDIDRACO 24
oxygeneios POLYPRION 55

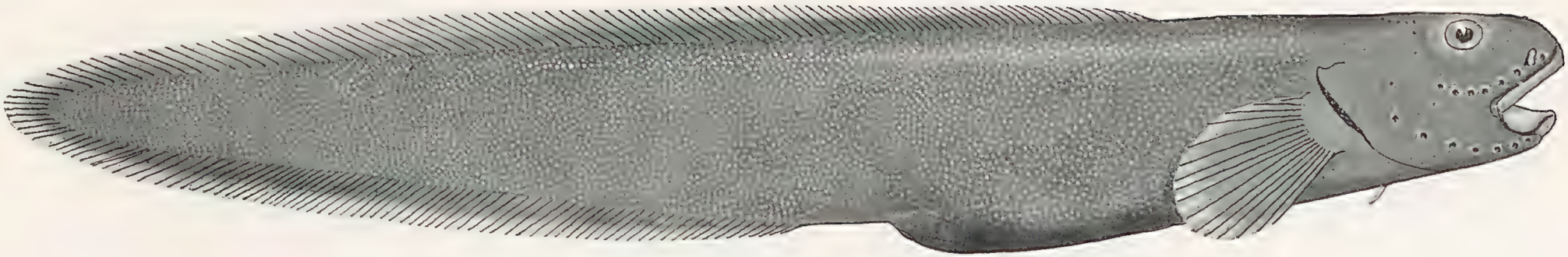
PAGETODES 40
antarcticus 40
PAGETOPSIS 37, 38, 40
macropterus 10, 11, 12, 15, 37, 39
palliolatus HARPAGIFER 70
palmatus PHYSICULUS 77
pappenheimi CRYODRACO 40
PARACHÆNICHTHYS 32, 33
PARALIPARIS 9, 43
antarcticus 44, 81

PAGE.
PARALIPARIS bathybii 44
terræ novæ 81
wildi 10, 12, 43, 44, 81
PARAPERCIS 79
allporti 74, 79
ocularis 79
parva NOTOTHENIA 69
pennellii TREMATOMUS 10, 11, 20, 21
PERCIS allporti 79
percoides HELICOLENUS 78
SCORPÆNA 74, 78
SEBASTAPISTES 78
SEBASTES 78
PHYSICULUS 77
barbatus 74, 77
palmatus 77
PLEURAGRAMMA 22
antarcticum 10, 12, 15, 22
POGONOPHRYNE 26
scotti 10, 11, 26
POLYPRION americanus 55
oxygeneios 55
porteri NOTOTHENIA 66
PRIONODRACO 35
evansii 10, 11, 12, 35
PRISTIOPHORIDÆ 51
PSEUDOPHYSIS barbatus 77

RACOVITZAIA 30, 63
RAIA eatoni 46, 49
murrayi 46, 49
rhinoceratus CHÆNICHTHYS 46, 50
RHOMBOSOLEA tapirina 46, 49
robustum TRYPTERIGIUM 71
roseo-pictus BOVICHTHYS 77
rostrata ANTIMORA 76, 77
rugosus CHÆNICHTHYS 46, 50

SARDINA neopilchardus 81
SCOPELUS antarcticus 59
colletti 59
SCORPÆNA 78
barathri 78
percoides 74, 78
SCORPÆNIDÆ 72, 78
scotiæ BATHYDRACO 28
scotti NOTOTHENIA 21
POGONOPHRYNE 10, 11, 26
TREMATOMUS 10, 11, 12, 21
SCYMNORHINIDÆ 51

PAGE.
SCYMNORHINUS 52
SEBASTAPISTES percoides 78
SEBASTES percoides 78
shackletoni ARTEDIDRACO 10, 11, 23, 24
sima NOTOTHENIA 19
skottsbergi ARTEDIDRACO 23, 24
SOMNIOSUS 45, 47, 49, 51, 52
spinifer ZANCLORHYNCHUS 45, 46, 47, 50, 72
SQUALIDÆ 51, 52
squamifrons NOTOTHENIA 46, 50
STOMATIIDÆ 53
SUDIDÆ 47, 56, 74
SYNGNATHUS blainvillianus 46, 49
tapirina RHOMBOSOLEA 46, 49
terræ novæ PARALIPARIS 81
TREMATOMUS 18, 19, 47
bernacchii 10, 11, 19
centronotus 10, 11, 12, 21
eulepidotus 10, 11, 12, 21, 22
georgianus 19
hansoni 10, 12, 19, 20
lepidorhinus 21
loennbergii 10, 11, 12, 20
newnesi 10, 11, 18
nicolai 10, 12, 18
pennellii 10, 11, 20, 21
scotti 10, 11, 12, 21
TRIGLIDÆ 79
TRIPTERYGION 71
capito 71
nigripenne 71
varium 46, 50, 71
TRIPTERYGIUM jenningsi 71
TRYPTERIGIUM robustum 71
TRYPTERYGIUM fenestratum 71
forsteri 71
variabilis CORYPHÆNOIDES 76
variegatus BOVICHTHYS 46, 49, 63, 77
varius BLENNIUS 71
varium TRIPTERYGION 46, 50, 71
viola ANTIMORA 74, 76, 77
HALOPORPHYRUS 76
whitsoni CHALINURA 10, 11, 14
wildi PARALIPARIS 10, 12, 43, 44, 81
ZANCLISTIUS elevatus 74, 78
ZANCLORHYNCHUS 47, 48, 72
spinifer 45, 46, 47, 50, 72
ZOARCIDÆ 14



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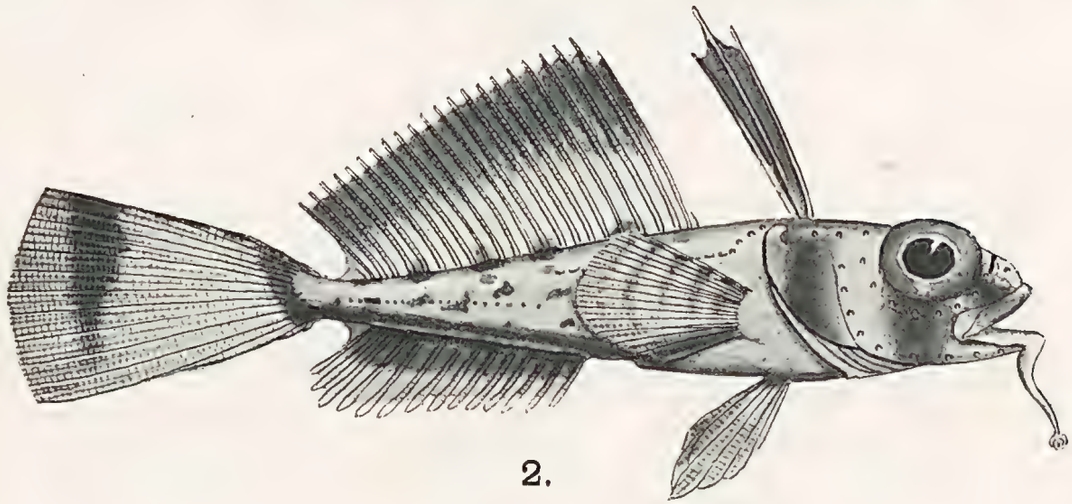

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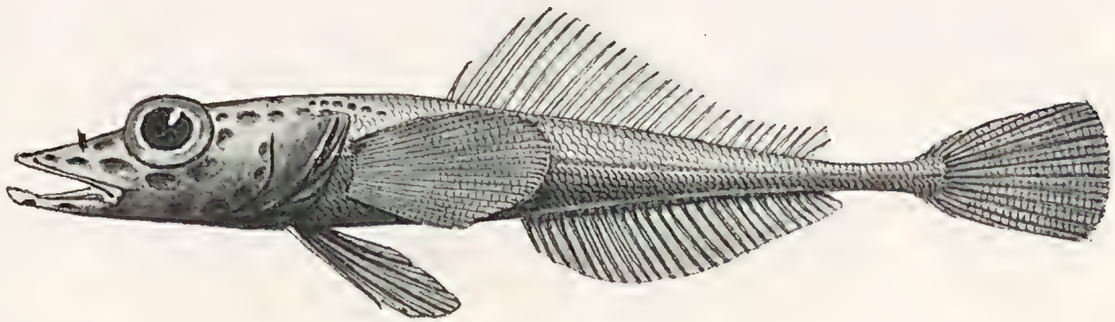

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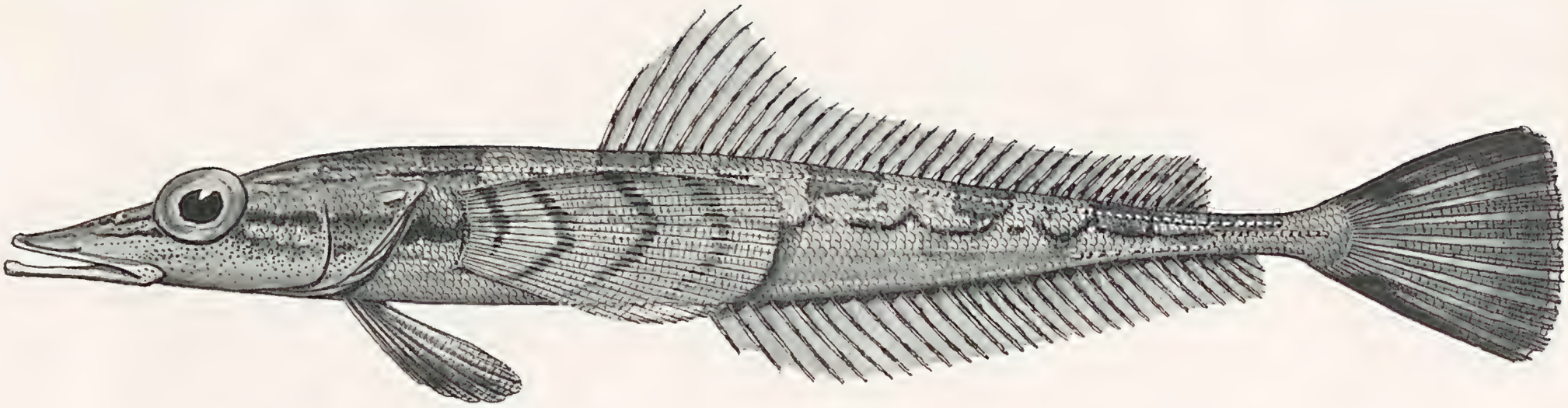

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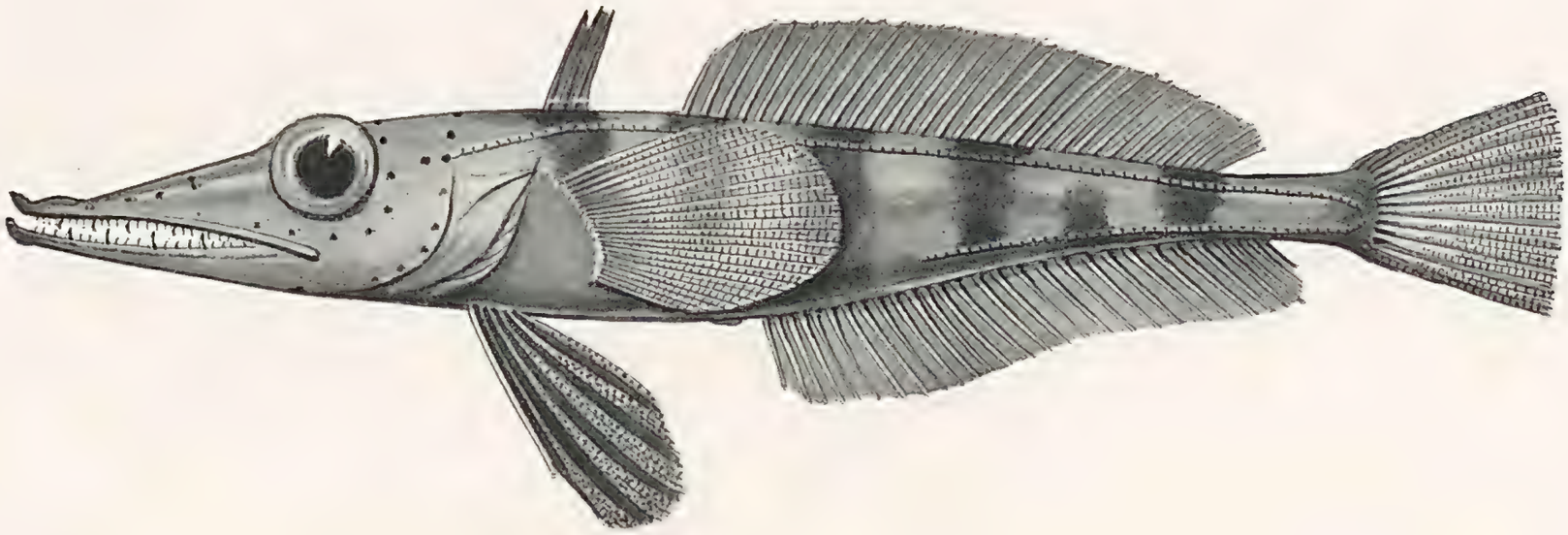

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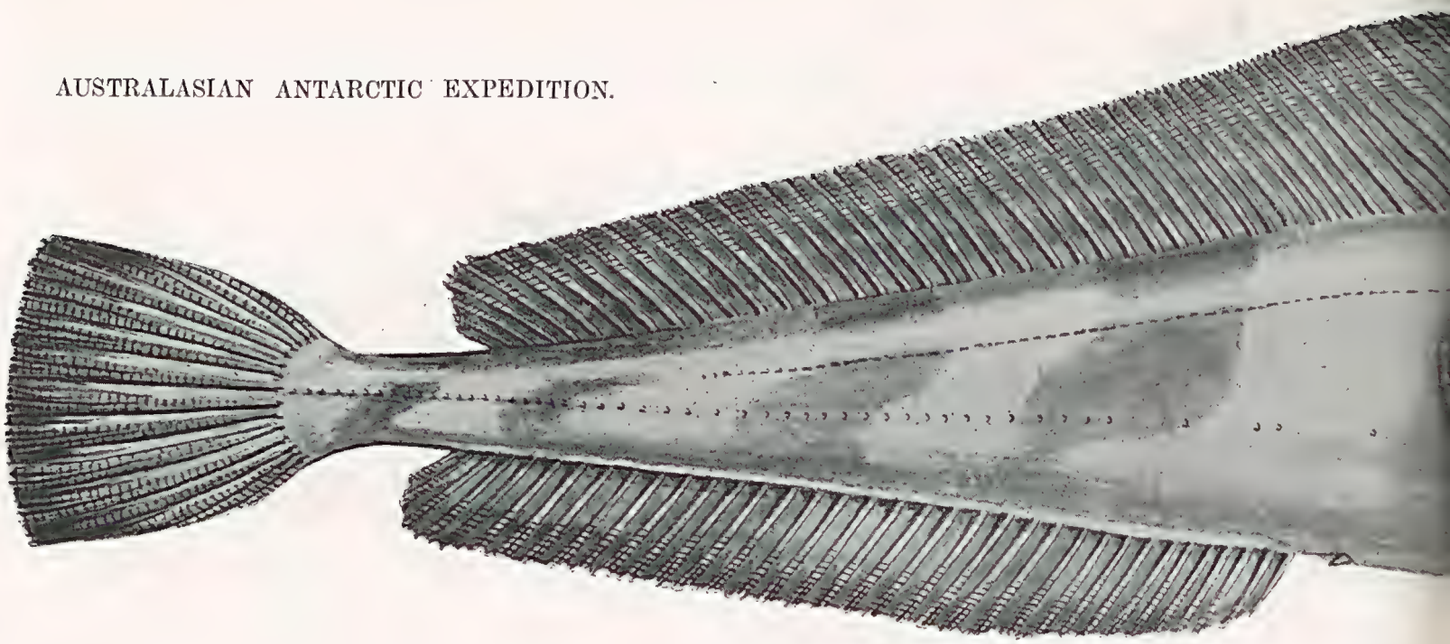

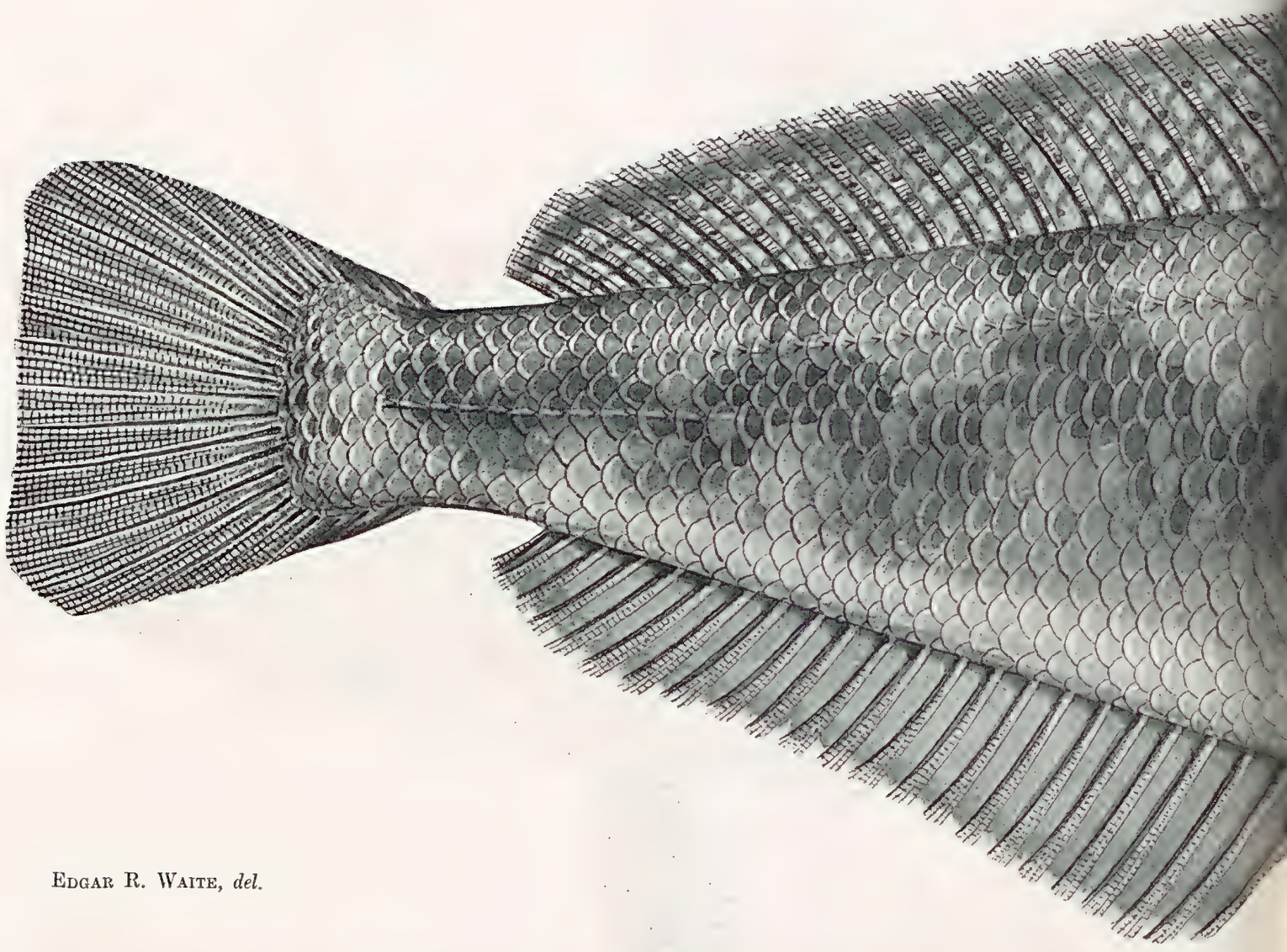

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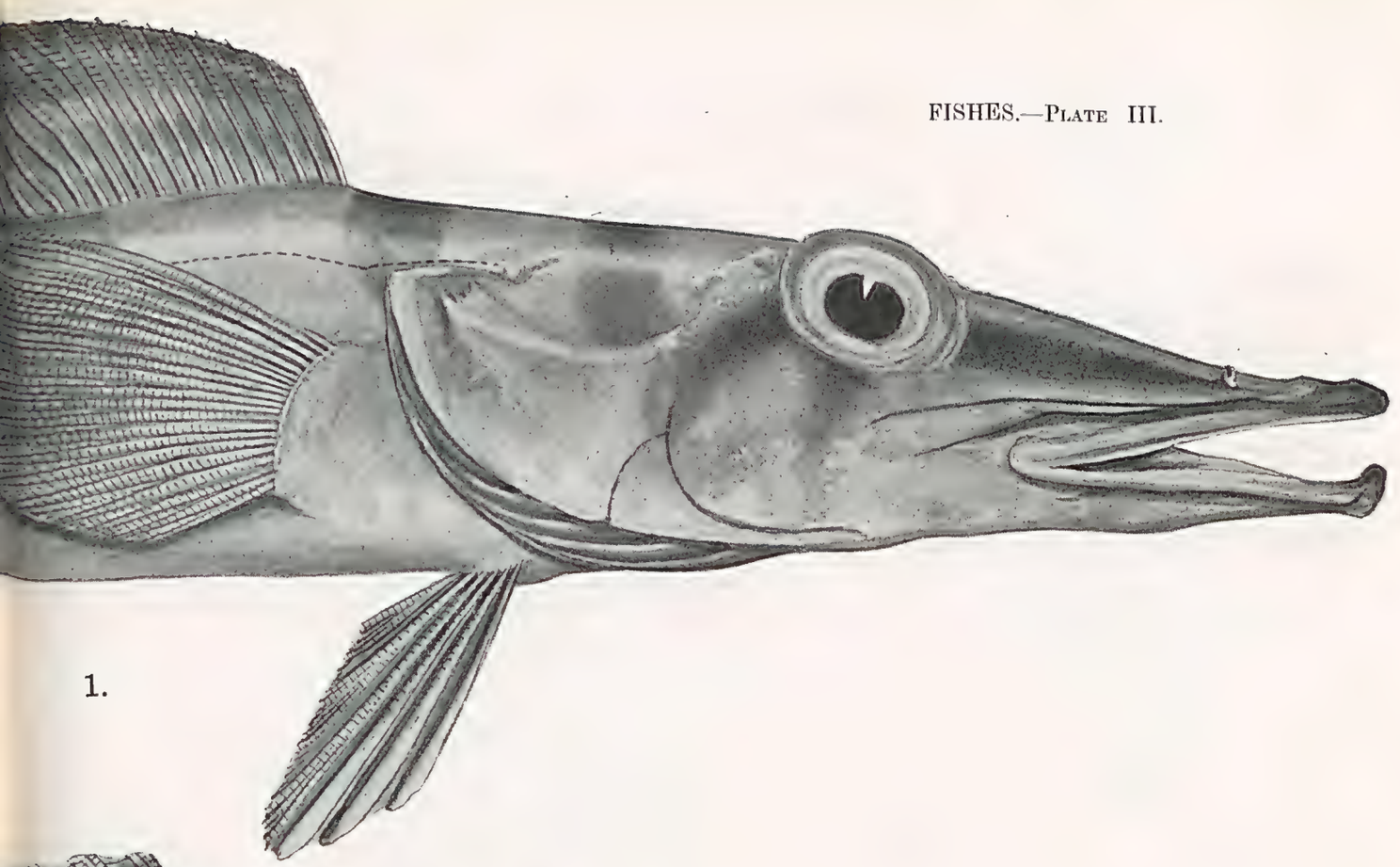

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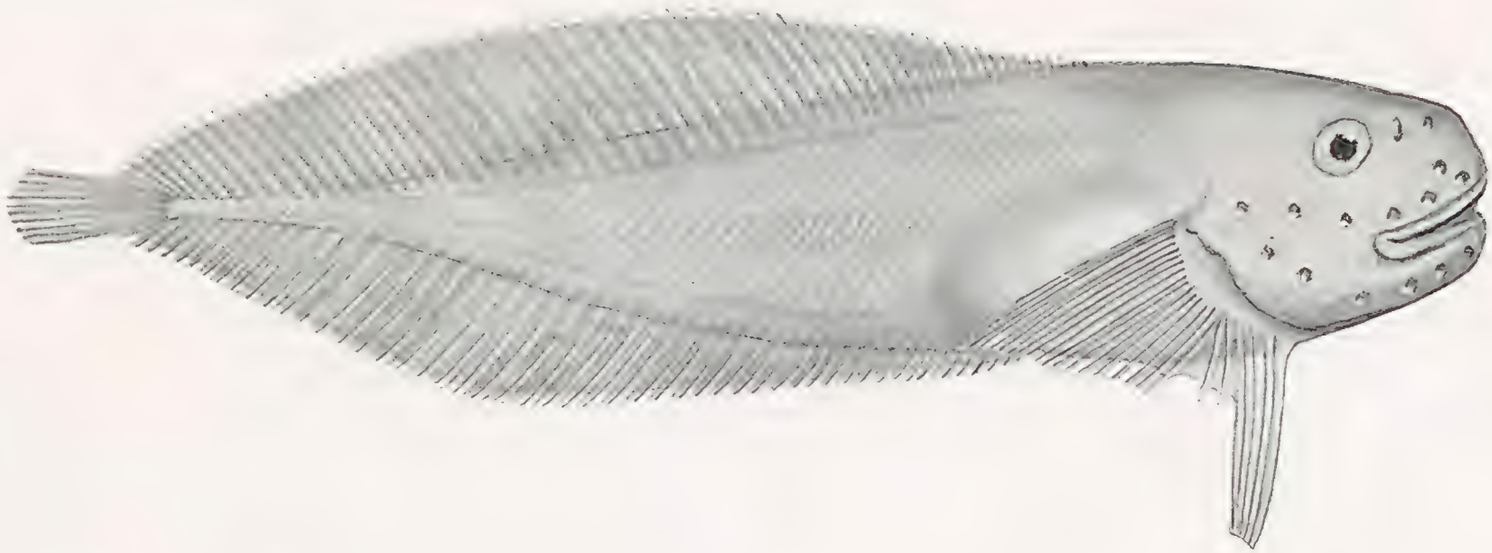

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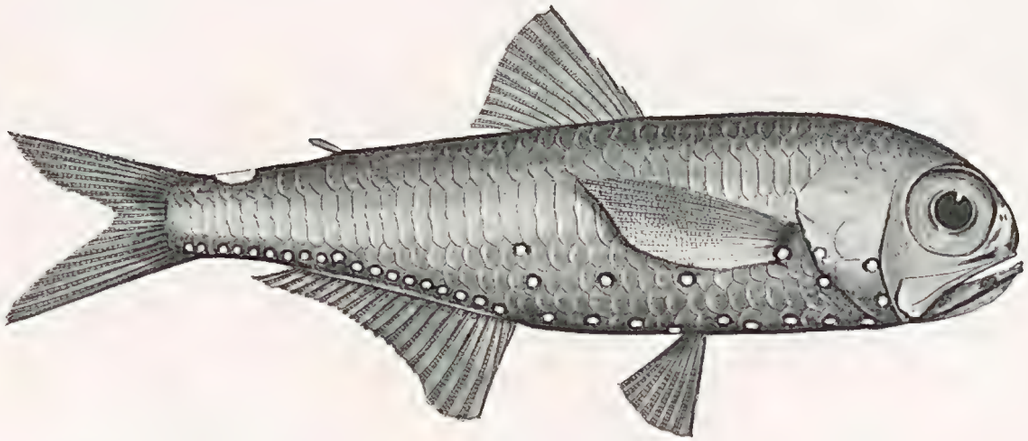

Edgar R. Waite, *del.*

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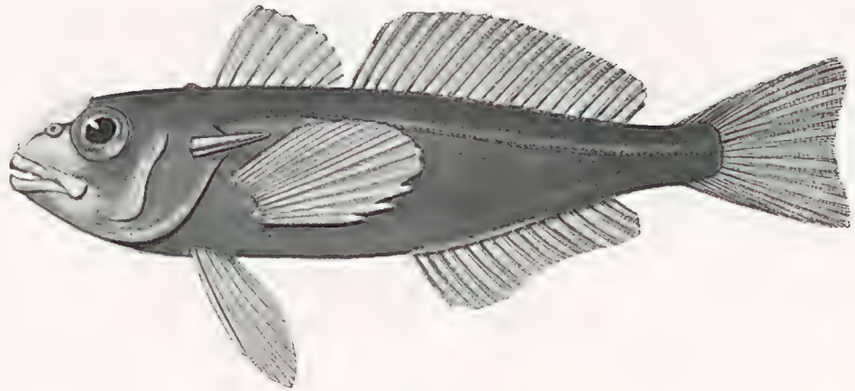

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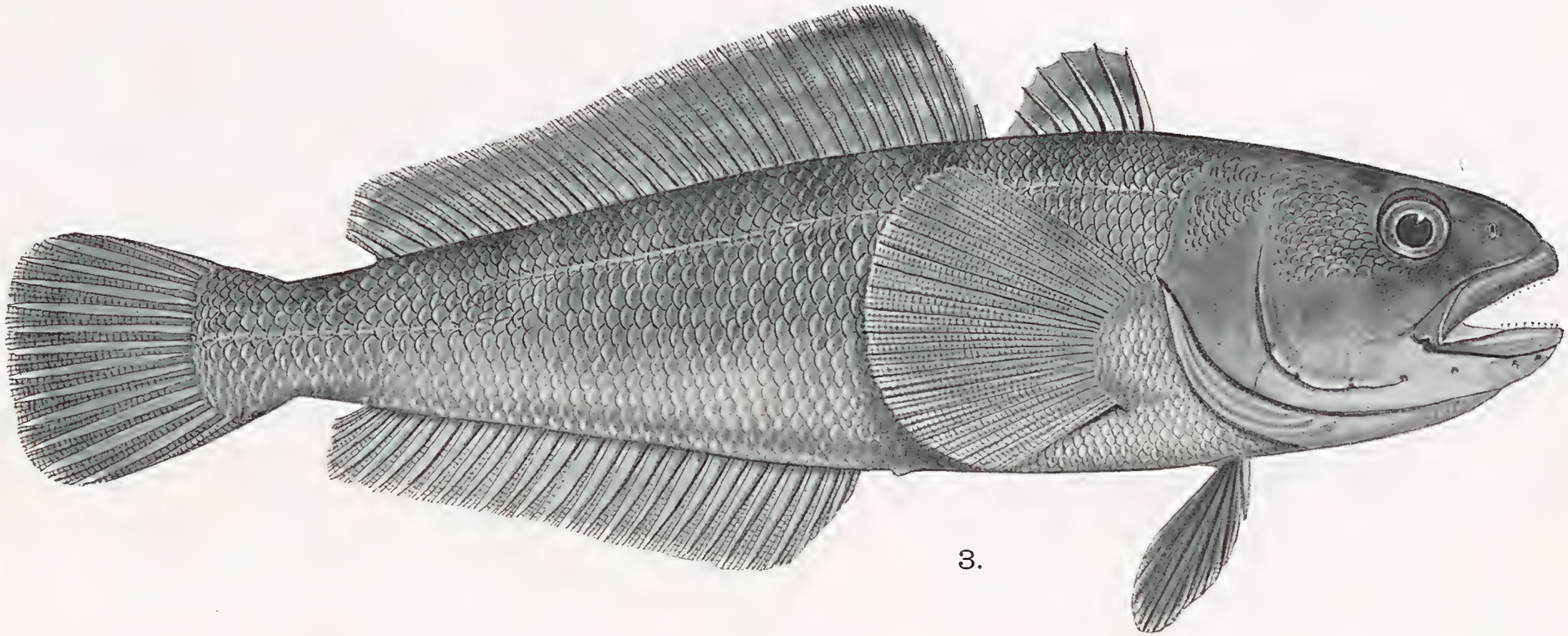

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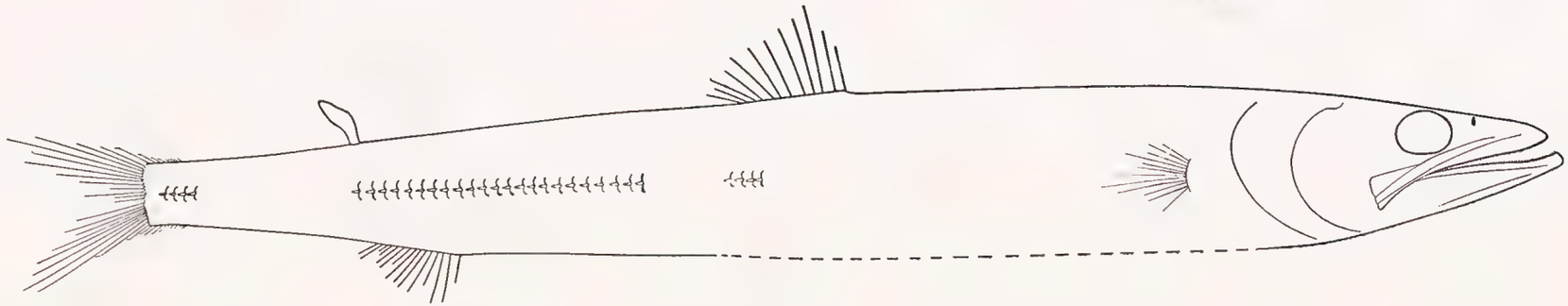

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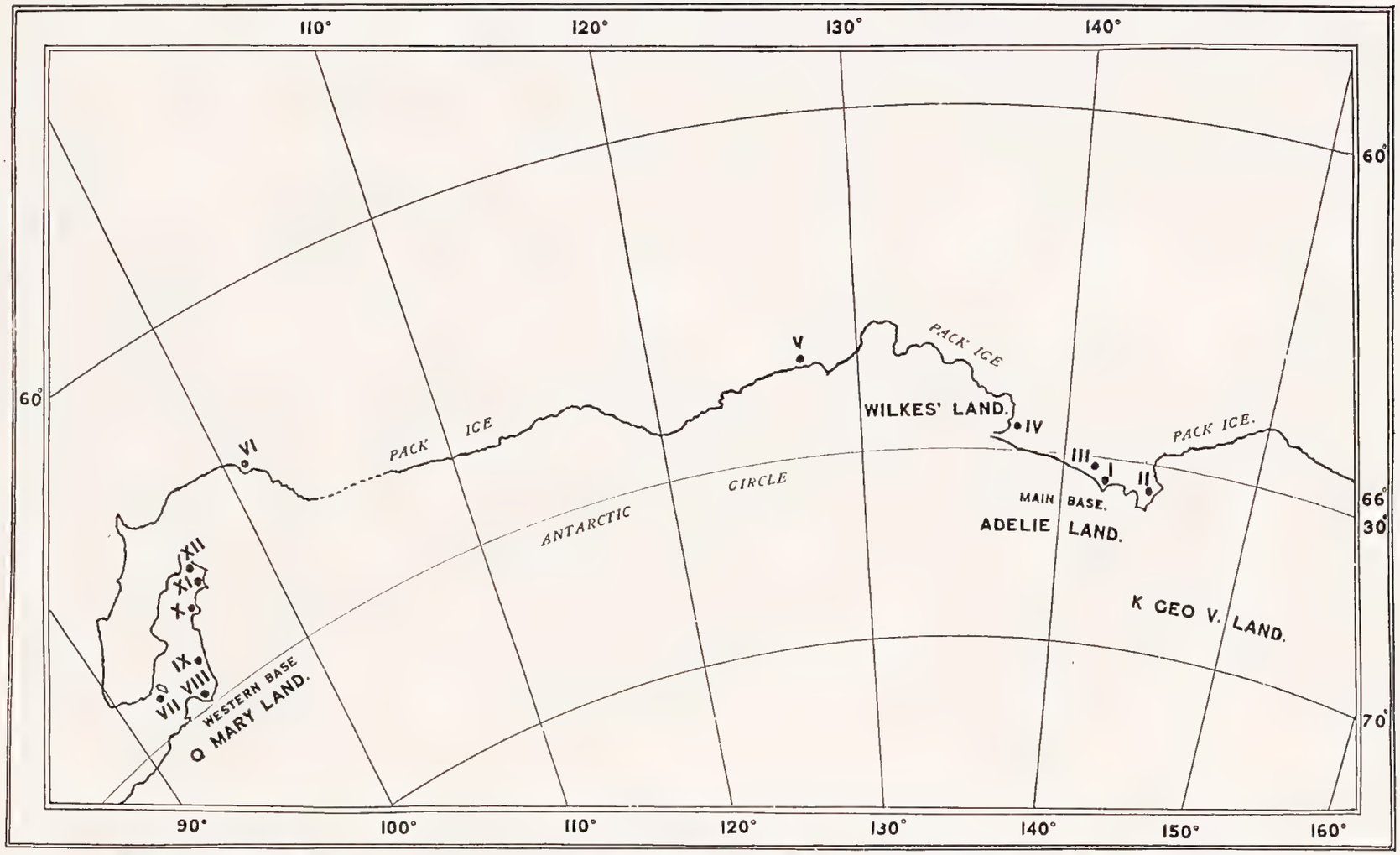
Edgar R. Waite and H. M. Hale, *del.*



MAP SHOWING the COLLECTING STATIONS of the "AURORA," 1912–1914.

(Indicated by Roman Numerals).

Number VII. indicates the Station off Drygalski Island at the entrance to Davis Sea.

Numbers VIII.–XII. indicate the Stations off Shackleton Ice Shelf.

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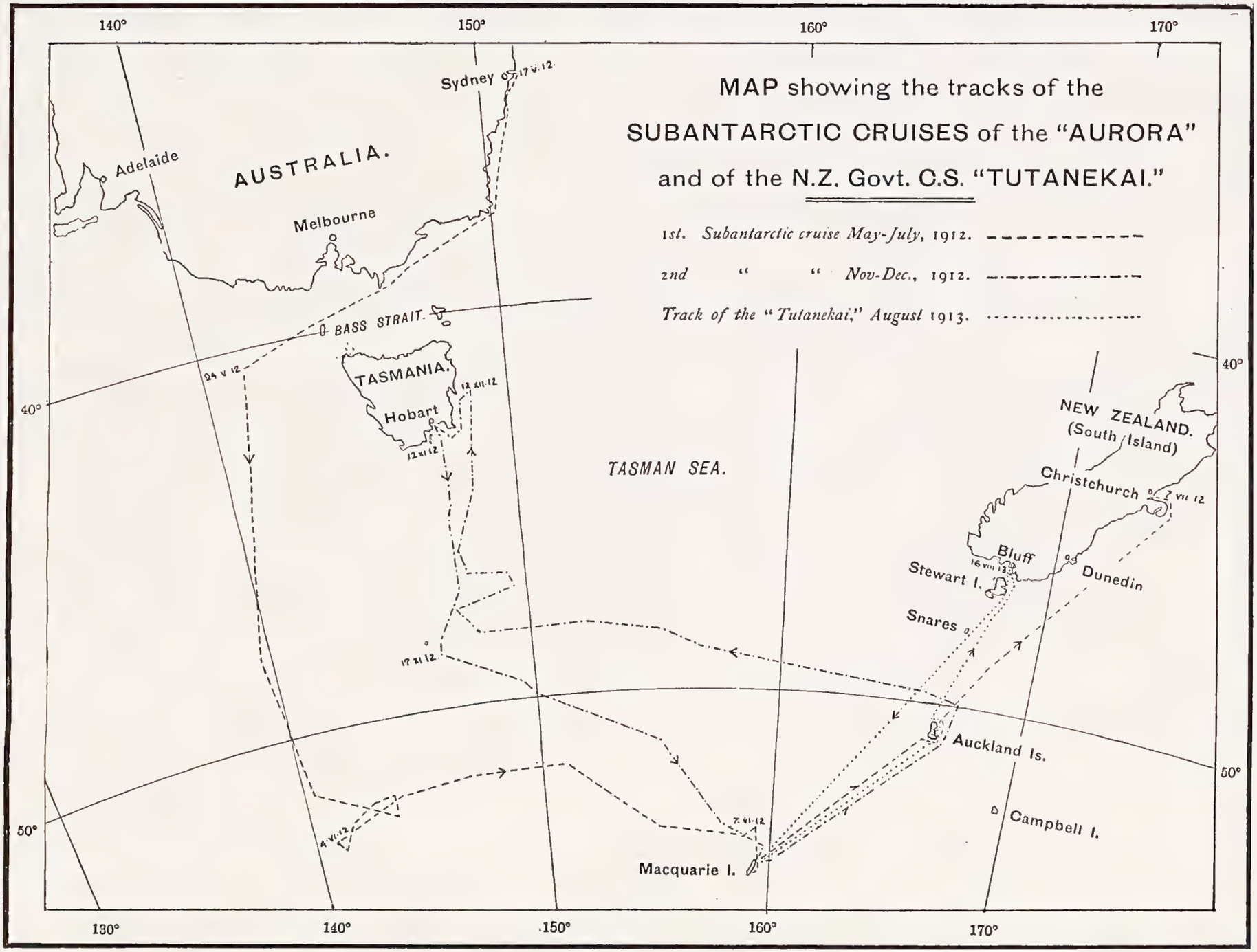
MAP showing the tracks of the
SUBANTARCTIC CRUISES of the "AURORA"
and of the N.Z. Govt. C.S. "TUTANEKAI."
1st. Subantarctic cruise May-July, 1912.
2nd " " Nov-Dec., 1912.
Track of the "Tutanekai," August 1913.
140°
150°
160°
170°
130°
40°
50°
AUSTRALIA.
Sydney
17 V. 12.
Adelaide
Melbourne
BASS STRAIT.
24 V 12
TASMANIA.
Hobart
12 XII 12
12 XII 12
17 XII 12
TASMAN SEA.
NEW ZEALAND.
(South Island)
Christchurch
7 VII 12
Bluff
16 VIII 13
Stewart I.
Dunedin
Snares
Auckland Is.
Campbell I.
Macquarie I.
7 VII 12
4 VI 12

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2019

AUSTRALASIAN ANTARCTIC EXPEDITION

1911-14.

UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, D.Sc., B.E.

SCIENTIFIC REPORTS.

SERIES C.—ZOOLOGY AND BOTANY.

VOL. III. PART 2.

PTEROBRANCHIA

BY

W. G. RIDEWOOD, D.Sc.,

British Museum (Natural History).

With Two Plates and Three Text-figures.

PRICE: TWO SHILLINGS AND SIXPENCE
TO SUBSCRIBERS: TWO SHILLINGS.

Printed by William Applegate Gullick, Government Printer, Phillip-street, Sydney.—1918.

ISSUED 15th JUNE, 1918.

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CONTENTS.

	PAGE
Introduction	5
Localities	7
Material obtained	7
Genus *Cephalodiscus*	8
Sub-genera of *Cephalodiscus*	8
Cephalodiscus hodgsoni	9
Cephalodiscus nigrescens	13
Cephalodiscus solidus	15
Cephalodiscus densus	22
References	23
Explanation of the Plates	24
Plates.	

NATIONAL MUSEUM MELBOURNE

THE PTEROBRANCHIA.

By W. G. Ridewood, D.Sc.

With Two Plates and Three Text-figures.

INTRODUCTION.

The genus *Cephalodiscus* was founded by McIntosh (8) in 1882, for specimens which he described as *Cephalodiscus dodecalophus*, dredged by the "Challenger" in 1876 in the Straits of Magellan, from a depth of 245 fathoms. These specimens, described more fully in 1887 (9), remained for a long time the only known material of *Cephalodiscus*.

In 1903 Andersson (1) announced that *Cephalodiscus* had been re-discovered on the Swedish South-Polar Expedition, and since that date no less than fourteen new species have been described.

The report by Harmer (5) upon the Pterobranchia of the "Siboga" Expedition of 1899–1900, published in 1905, furnished descriptions of three new species. Two of these were obtained on the expedition itself:—*C. gracilis*, from the east coast of Borneo, between tide-marks, and *C. sibogae*, from the South-east of Celebes, from a depth of 41–51 fathoms; the third species, *C. levinseni*, was based upon a specimen belonging to the Copenhagen Museum, obtained off the West coast of Japan, from a depth of 100 fathoms.

The National Antarctic ("Discovery") Expedition of 1901–1904 obtained two new species from Ross Sea, one of which, *C. nigrescens*, from off Coulman Island, at a depth of 100 fathoms, was described briefly by Lankester (7) in 1905, and more fully by Ridewood in the report on the Pterobranchia of that expedition (11).

There is reason to believe that material of *C. nigrescens* was obtained from Ross Sea as far back as 1841 or 1842 on the "Erebus" and "Terror" Antarctic Expedition, but the material remained in the British Museum, unidentified until it was described by Ridewood in 1912 (13). *C. nigrescens* has since the "Discovery" Expedition been obtained from the Graham Region at a depth of 137 fathoms by the second French Antarctic ("Pourquoi Pas?") Expedition of 1908–1910, and is described by Gravier (4) in the reports of that expedition; also from Ross Sea by the British Antarctic ("Terra Nova") Expedition of 1910–1913, at depths varying from 190 to 300 fathoms, and

described by Ridewood (*report not yet published.*—W.G.R., 2nd September, 1917); and on the Australasian Antarctic Expedition of 1911–1914 from off Queen Mary Land, at a depth of 120 fathoms (*vide infra*, p. 00).

The other new species obtained on the "Discovery" expedition was described under the name *C. hodgsoni* by Ridewood (11). The material was dredged from three localities in Ross Sea at depths of 100, 130 and 300 fathoms. More material of the same species has since been obtained on the British Antarctic ("Terra Nova") Expedition of 1910–1913 from Ross Sea, at depths of 140 to 300 fathoms (Ridewood, *vide supra*); also on the Australasian Antarctic Expedition of 1911–1914 from off Adelie Land, at a depth of 354 fathoms, and from off Queen Mary Land at depths of 110 and 120 fathoms (*vide infra*, p. 13).

From the South Coast of the Cape of Good Hope Dr. Gilchrist collected during the years 1900–1904, from depths of 29 to 130 fathoms, material of *Cephalodiscus* which proved to be of a new species, and was described by Ridewood in 1906 (10) as *C. gilchristi*.

In 1907 Andersson (2) published in the Report on the Pterobranchia of the Swedish South-Polar ("Antarctic") Expedition of 1901–1903, descriptions of the re-discovered *C. dodecalophus*, and five new species, two of them, *C. aequatus* and *C. inaequatus*, bearing a general resemblance to *C. dodecalophus* and *C. hodgsoni*,* while the other three, *C. solidus*, *C. densus* and *C. rarus*, were markedly different from any of the species at that time known. This material was obtained from six localities in the Graham Region, the Falkland Islands and the Beagle Channel, from depths ranging between 44 and 128 fathoms.

Specimens of *C. densus* have since been obtained in Ross Sea, and are described by Ridewood in the Report on the Pterobranchia of the British Antarctic ("Terra Nova") Expedition of 1910–1913, and a piece was obtained on the Australasian Antarctic Expedition of 1911–1914 from off Queen Mary Land at a depth of 120 fathoms (*vide infra*, p. 22). *C. solidus* was also re-discovered on the latter expedition (p. 15), the material being secured off Adelie Land at a depth of 318 fathoms.

An Indian species was discovered by Schepotieff in 1908 off the Malabar Coast and off Ceylon, at depths of 5 to 11 fathoms, and in 1909 was described by him (14) as *C. indicus*.

Another new species was obtained on the Scottish National Antarctic ("Scotia") Expedition of 1902–1904, from the Burdwood Bank, Falkland Islands, at a depth of 56 fathoms. This was described in 1913 as *C. agglutinans* by Harmer and Ridewood (6).

The last new species is one obtained from the North of New Zealand at a depth of 100 fathoms on the British Antarctic ("Terra Nova") Expedition of 1910–1913; the description of this will appear in the report on the Pterobranchia of the expedition.

* There is reason to believe that *C. inæquatus* is not specifically distinct from *C. hodgsoni*. (See 6, pp. 559–563.)

LOCALITIES.

The material of *Cephalodiscus* obtained on the Australasian Antarctic Expedition of 1911–1914 under the leadership of Sir Douglas Mawson was dredged off Adelie Land and off Queen Mary Land from the four Stations enumerated below.

Station I—In Commonwealth Bay, Adelie Land; Lat. 66° 50′ S.; Long. 142° 6′ E.; 22nd December, 1913; 354 fathoms; temperature, 1·85° C.

Station II—Off Mertz Glacier; Lat. 66° 55′ S.; Long. 145° 21′ E.; 28th December, 1913; 318 fathoms; temperature, 1·84° C.

Station VIII—Lat. 66° 8′ S.; Long. 94° 17′ E.; 27th January, 1914; 120 fathoms; temperature not taken.

Station XII—Off Shackleton Glacier; Lat. 64° 32′ S.; Long. 97° 20′ E.; 31st January, 1914; 110 fathoms; temperature not taken.

At Stations I and II there was a bottom of thick ooze; at Stations VIII and XII the bottom was clear with no evidence of any ooze.

MATERIAL OBTAINED.

The material of *Cephalodiscus* obtained on the Expedition includes no new species. Four species are represented—*C. hodgsoni*, *C. nigrescens*, *C. solidus*, and *C. densus*. More than half of the bulk of the material consists of *C. hodgsoni*, dredged from Stations I, VII, and XII; but all that came from Stations I and VIII is "dead"—that is to say, it consists of coenœcium only, with no zooids. The dredge at Station VIII yielded also *C. nigrescens* and *C. densus*, one piece of each. *C. solidus* was obtained from Station II.

The collection occupies seven bottles, each of a capacity of about 900 cc. Denoting these bottles by the letters A—G, bottle A (from Station I), and bottle C (from Station VIII) contain "dead" *C. hodgsoni* only. Bottle D (also from Station VIII) contains *C. densus* and *C. nigrescens* and some "dead" *C. hodgsoni*. Bottles E, F, and G (from Station XII) contain *C. hodgsoni* only, and bottle B (from Station II) *C. solidus* only.

The material was fixed either in corrosive sublimate solution, or corrosive sublimate acetic acid solution, or 5 per cent. chromic acid solution, and subsequently transferred to alcohol. The preservation of the zooids of *C. hodgsoni* is good, but in the case of the other three species, in which the zooids live in separate tubes closed at the bottom, the appearances suggest that the zooids had withdrawn into the deeper parts of the tubes, and had undergone a certain amount of disintegration before the fixing fluid had diffused down the tubes to reach them in a sufficiently undiluted form to be effective.

Genus Cephalodiscus.

Genus *Cephalodiscus* M'Intosh. Zooids small, living as a social community within a secreted coenœcium, from the orifices or ostia of which they can emerge at will; coenœcium with a common branching cavity, or with a separate tubular cavity for each zooid and its buds. Body of the zooid consisting of three parts, with separate divisions of cœlom—first part a shield, in the form of a flattened preoral disc, with a curved red line, used for crawling and for secreting the coenœcium, containing a single cœlomic cavity, which opens to the exterior by a pair of pores; second part a collar-region, with a paired cœlomic cavity, which opens to the exterior on each side by a ciliated canal; collar produced antero-dorsally into a lophophore of several pairs of arms, each arm with two rows of tentacles; collar produced postero-ventrally into an oral lamella; central nervous system situated in the ectoderm at the bases of the arms; third part, the largest, a trunk-region, with closed cœlomic cavity, primarily paired, containing the alimentary canal and gonads. Alimentary canal U-shaped, mouth ventral, behind the stalk of the shield; anus on the antero-dorsal surface of the trunk, near the bases of the arms. One pair of pharyngeal pores or gill-slits near the collar-canals. A more or less tubular notochord projecting from the antero-dorsal wall of the pharynx; below it, in the shield, a pericardial sac, with heart. Gonads simple, one pair, opening by short ducts near the anus. Trunk prolonged posteriorly or ventrally, according to the degree of extension of the zooid, into a stalk, with a terminal sucker, around the edge of which buds are produced.

Sub-genera of Cephalodiscus.

Subgenus *Demiothecia* Ridewood.—Colony branching. Each ostium of the coenoecium leading into a cavity which is continuous through the colony, and is occupied in common by the zooids and their buds. Transverse sections of the branches showing the central cavity surrounded by a wall of coenœcial substamce, usually of irregular thickness, and sometimes with inwardly projecting bars and ridges.

Subgenus *Idiothecia* Ridewood.—Colony branching. Each ostium of the coenœcium leading into a tube which is occupied by one zooid and its buds. The tubes embedded in common coenœcial substance, and disposed at a more or less constant angle to the surface; the tubes either blind at their inner ends, or connected up by intercommunicating tubes in the middle of the branch.

Sub-genus *Orthœcus* Andersson.—Colony not branching, but in the form of a cake, or cone, or mass of irregular shape. Each ostium of the coenœcium leading into a tube which is occupied by one zooid and its buds. The tubes embedded in common coenœcial substance, either for their whole length or towards their lower, blinds ends only; the tubes more or less vertical, either closely set and parallel, or irregularly bent and straggling.

Cephalodiscus hodgsoni.

(Plate VI.)

Cephalodiscus (*Demiothecia*) *hodgsoni* Ridewood (11).

Colony irregularly branched, without cross-bars connecting up the branches. Maximum size of known specimens 250 mm. high, 150 mm. wide. Width of a branch, not including spines, mostly 4 to 6 mm., but some terminal branches as narrow as 3 mm., and some basal stems as thick as 9 mm. Cavity of coenœcium irregular, continuous, and occupied in common by the zooids and their buds, inner surface smooth, cavity sometimes traversed by solid bars. Older parts of the coenœcium of a deep amber colour, younger parts colourless. Ostia numerous, irregularly placed, oval, lateral or terminal; terminal ostia rather funnel-shaped, about 3 by 2 mm., lateral ostia smaller, mostly sessile; each ostium with from two to five long, more or less radiating spines, simple, forked, or branched; length of spines up to 20 or 25 mm., but the spines of rapidly growing terminal branches commonly shorter (8 to 12 mm); spines frequently connected by crossbars, forming an imperfect meshwork; width of spines 0·6 to 1·0 mm., in terminal branches sometimes not more than 0·4 mm. Zooids—length from free ends of the arms to end of body of a fairly extended zooid 2·4 to 3·2 mm.; length from bases of arms to end of body 1·0 to 1·8 mm.; width of body 0·6 to 1·0 mm. Colour (of preserved zooids) crimson-brown or pale brown, fading to ochreous and cream-colour; male zooids commonly redder in tint than female. On the assumption that *C. inæquatus* is synonymous with *C. hodgsoni* (6, pp. 559–563), colour of living zooids red or crimson, the body darker and more brown than the arms. Arms five or six pairs, axis of each arm with an end-swelling, with refractive beads. Male and female zooids and hermaphrodites (with one ovary and one testis) occurring in the same colony, but males or females usually preponderating. Testes short. Free ova measuring 0·45 by 0·33 mm., attached by a stalk. Buds two, sometimes three or four, to each zooid.

Material of *Cephalodiscus hodgsoni* was obtained from Stations I, VIII and XII, but that from Stations I and VIII is " dead," consisting of coenœcium only, with no zooids. The coenœcial substance of *Cephalodiscus*, although shown in Andersson's report (2, p. 20) to be albuminoid in character, seems to be remarkably resistant, and probably remains more or less unaltered at the bottom of the sea for many years after it has ceased to be inhabited. That some sort of change, however, does take place is apparent from the fact that the " dead " material in bottles A, C and D (see p. 7) has suffered more in transit from Australia to London than has the material, with zooids, in bottles E, F and G. The " dead " material is more brittle, and has broken up to a greater extent, in consequence of the unavoidable shaking of the bottles, than the rest of the material.

The specimens (*i.e.*, pieces of colony) of *C. hodgsoni* with zooids still within (bottles E, F and G, from Station XII), although brought up together, present considerable differences in appearance that are not likely to be attributable to the fact that some of the pieces of material were fixed in chromic acid solution and others

in corrosive sublimate solution. At first glance one might hesitate to say that the two colonies represented in figs, 1 and 5 in plate VI belonged to the same species. The former is pale in colour, of an amber tint, fading off in places to lighter shades; the latter is very dark in colour, a dark brown, verging on black. The former is a characteristic piece of *C. hodgsoni*, showing forking of the spines, and cross-connections forming a coarse network, the latter shows forking of the spines, but only occasional cross-connections. The appearance, moreover, of the latter rather suggests that the colony was allowed to dry partially before being plunged into the fixing fluid, for some of the spines, while of normal dimensions in their basal parts are much thinner and of a shrivelled appearance distally, and there is a certain matting of the spines which is clearly unnatural.

No differences between the two colonies are to be noted in the structure of their zooids, so that the arguments must be based upon the coenœcial characters alone. In the same bottle (bottle G) with the specimen shown in fig. 1 are other fragments (*e.g.*, fig. 2) of a much deeper tint, and with the coenœcial substance and spines firmer and less flexible. This firmness and dark amber colour are known to be characteristics of the older parts of colonies of *C. hodgsoni*; such parts rarely have zooids, and in the abundant material of *C. hodgsoni* obtained on the "Terra Nova" Expedition large colonies are commonly met with in which the basal parts are as shown in fig. 2 and the upper parts, full of zooids, as in fig. 1, with an even gradation from one to the other extending over a distance of several inches. Fragments of colony of intermediate character are also found in bottle G of the Australasian Expedition, and one such piece is shown in fig. 3. It is less "brambly" than that represented in fig. 2, and intermediate in colour between the pieces shown in figs. 2 and 1; it has numerous zooids.

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Another piece from the same bottle (fig. 4) shows an abrupt transition from the basal, brambly, dark-tinted, stiff, empty coenœcium to the terminal, pale, delicate, flexible part, full of zooids. While it is known, from a study of the material collected by the "Terra Nova," that a colony of one species of *Cephalodiscus* may grow upon a base of another species—the cases in point are *C. hodgsoni* growing on *C. nigrescens*—yet there can be little doubt in the present instance that there is here a new growth of *C. hodgsoni* upon an old and rather damaged basal piece of colony of the same species.

Continuing the argument with regard to the piece of colony represented in fig. 5, there are found in the same bottle with it (bottle E) basal pieces of the brambly kind. One of these (fig. 6) is of special interest in that, while most of it is of the deep amber tint characteristic of basal parts of colonies of *C. hodgsoni*, its upper part merges into a very dark brown or blackish part exactly resembling that which forms the bulk of the piece shown in fig. 5.

Other pieces of colony in bottle E are growing upon the skeletal axis of a kind of *Isidella*, probably *Ceratoisis*, and the general character of the branching of the colony is determined by that of the Alcyonarian; in many places the calcareous axis is but thinly coated over with coenœcial material, there being no cavity occupied by zooids.

Disregarding the differences in the colour of the colonies shown in figs. 1 and 5, the differences in general facies would seem to be attributable to differences in the rate of growth; one would conclude, that is to say, that the former has been built up rapidly, whereas the latter is a slowly-grown colony.

The specimens in bottle F call for no particular comment. The largest piece of colony is a little smaller than that shown in fig. 5; it has the appearance of being a slowly-grown colony, and is more characteristic, both in tint and general facies, of *C. hodgsoni* than is the material of bottle E.

The zooids in bottles F and G are well preserved—the material in bottle F was fixed in 5 per cent. chromic acid solution, and transferred to alcohol, and the fixation of the material of bottle G is not stated. The material in bottle E was fixed in corrosive sublimate solution, and transferred to alcohol, and the zooids are not in good condition; they are darker in colour than those of bottles F and G, and a little smaller. They have not been actually dried up, but their appearance and the shrunken look of the coenœcium suggest that the material had been allowed to become partially dry before being put into the fixing fluid. The zooids are extremely brittle, and the epithelium of the free portions of the tentacles of the arms is to a large extent missing, probably scoured off by the shaking of the bottles in transit, so that only the basement membrane remains, as a kind of skeletal axis.

As regards size, the zooids agree fairly well with one another, and with the typical material obtained on the National Antarctic ("Discovery") Expedition (11). In taking measurements it is only the fairly extended zooids that are considered; fourteen zooids were measured from the principal piece of colony of bottle E (fig. 5), fifteen from the largest piece in bottle F, and sixteen from that in bottle G (fig. 1). The first measurement given in the table below is the average of the measurements in millimetres from the tips of the arms to the caecal end of the body, the second is that from the bases of the arms to the end of the body, and the third is the width of the body.

Bottle E	—	2·4	—	0·95	— 0·53
Bottle F	—	2·4	—	1·1	— 0·57
Bottle G	—	2·9	—	1·4	— 0·66

The arms are mostly ten in number, sometimes nine, eleven or twelve; the axis of each has an end-swelling with highly refractive beads. It is not possible to decide whether the zooids in the material now under consideration show sexual dimorphism in the occurrence of five pairs of arms in females and six pairs in males, as is stated to be regularly the case in the material obtained on the Swedish South-Polar Expedition (Andersson, 2; *C. inaequatus* is regarded as the same as *C. hodgsoni*, see 6, pp. 559–563), for the whole of the material proves to be immature. Of the sixteen zooids examined from bottle G only one had gonads large enough to dissect out, and these were too small to enable one to judge the sex; of the fourteen zooids from bottle E, two had small ovaries, the others had gonads extremely minute, and too young to

enable one to decide whether they were ovaries or testes; the fifteen zooids examined from bottle F had no recognisable gonads at all; one might almost be tempted to call these neuter zooids, were it not for the fact that in the other material minute gonads were found, and in two of the zooids they were definitely recognisable as young ovaries.

In the zooids of bottle E the oral lamella has a much more even margin than is usual, and shows scarcely any scalloping, although the five lobes on each side can still be recognised. If, as is possible, the zooids were moribund when plunged into the fixing fluid, the conclusion may be drawn that the intensity of the scalloping in the oral lamella of *Cephalodiscus* is to a large extent a matter of muscular contraction at the time of death. That the zooids in bottle E were no longer vigorous when fixed is indicated by the fact that the stalk arises almost from the extremity of the trunk and not from the ventral surface. Andersson (2, plate 4) has observed that in living zooids there is no cæcal end to the body, but the stalk is terminal at the end of the trunk. The common appearance, in preserved material, of the stalk arising from some part of the ventral surface of the zooid, is in all probability due to the violent contraction, on death, of the great tract of ventral muscle that runs forward in the body from the root or origin of the stalk.

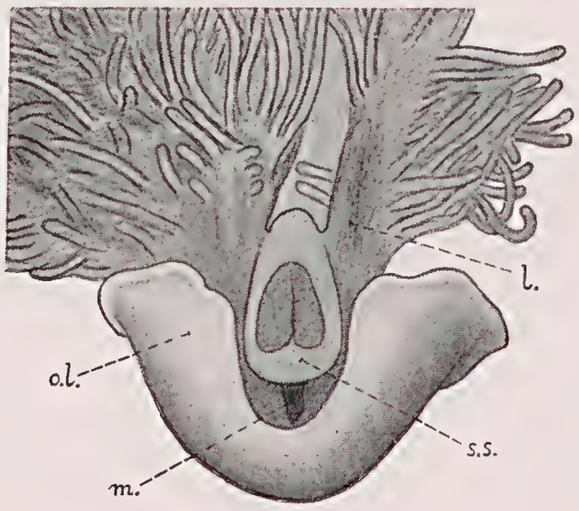

Fig. 1.

Text-fig. 1.—Oral region of a zooid of *C. hodgsoni* showing the oral lamella turned forward so as to direct the food-current into the mouth. *l*, base of lophophore; *m*, mouth; *o.l.*, oral lamella; *s.s.*, stalk of the shield cut across, showing the cavity within. Drawn by *camera lucida*. (× 90.)

The conclusion seems to be justified that the function of the oral lamella is to continue the system of ciliated grooves of the arm-axes and the basal parts of the lophophore towards the mouth. Andersson has stated it as his opinion that in living zooids the oral lamella is forwardly directed, so as to form a channel on each side leading from the base of the lophophore to the mouth (2, pp. 5 and 57); it is of considerable interest, therefore, to find, in preserved material, zooids having the oral lamella forwardly directed in a manner that would achieve this end (text-fig. 1). Only

two such zooids have been found in the present material, but confirmatory evidence is forthcoming from the abundant material collected on the British Antarctic ("Terra Nova") Expedition.

The buds in the material collected occur usually two, sometimes three, to each zooid. All stages are found, from minute pear-shaped projections from the edge of the extremity of the parent stalk, up to well-developed buds, with fully-grown arms, ready to separate off as independent zooids.

Cephalodiscus nigrescens.

(Plate VII, Fig. 2.)

Cephalodiscus (*Idiothecia*) *nigrescens* Lankester (7).

Colony massive branching; maximum size of known specimens—190 by 115 mm., with twelve branches; maximum width of a single branch—32 mm.; minimum width of a branch—5 to 9 mm.; branches roughly cylindrical, stout branches with rounded or tapering apices. Colour greyish, translucent. Ostia at the ends of short, tubular peristomes, but in main stems of the colony frequently sessile; abaxial edge of the peristome produced into a blunt lip, but with no prominent ridge continued downward from the lip. No spines. Each ostium leading into a tube that ends blindly in the middle part of the branch. Width of cavity of the tubes—1·2 to 1·3 mm.; length—12 to 17 mm. on an average, but longer (20 to 26 mm.) in thick stems, and very short (4 to 5 mm.) at the tips of the branches; the deeper parts of the longest tubes shut off by curved septa so that the habitable part of the tube is reduced (commonly 8 to 14 mm. in length). Zooids—length from free ends of the arms to end of body of a fairly extended zooid—4 to 6 mm.; length from bases of arms to end of body—2·5 to 3·5 mm.; width of body—about 0·9 mm. Colour (of preserved zooids) blackish. Arms usually 7 pairs, sometimes 6 or 8 pairs; in well preserved material fixed in formalin or in alcohol the tentacles pale and the axis rather broad, with two longitudinal black bands, but in material fixed in picric acid, and in badly fixed alcoholic material the tentacles and axis of a uniform dark brown or black colour; no end-swellings with refractive beads. Male and female zooids and hermaphrodites (with one ovary and one testis) occurring in the same colony. Testes long. Free ova—0·6 by 0·5 up to 0·9 by 0·7 mm, not stalked. Buds from 2 to 9 to each zooid.

Material of *Cephalodiscus nigrescens* was dredged from Station VIII. (Lat. 66° 8′ S.; Long. 94° 17′ E.; 120 fathoms; 27th January, 1914). It consists of three pieces, obviously portions of the same colony, for the broken surfaces can be so adjusted as to fit accurately the one against the other. The pieces were lightly sewn together before the photograph reproduced in Plate VII, fig. 2 was taken. The height is 65 mm., and the greatest width 50 mm.

The colony is not altogether typical of *C. nigrescens*. It is not possible to say whether the material under consideration is an upper portion of a large colony, or a colony complete in itself, for the base is missing; the probabilities are in favour of the latter alternative. Three places where growth is proceeding can be recognised, and these later on might have developed into branches; they are scarcely long enough yet to be designated by that term.

The tubes in the middle of the mass are long, as much as 30 mm. from the blind end to the extremity of the lip of the peristomial tube in some cases, and while their upper halves radiate, and stand out obliquely to the vertical axis, their inner and lower parts are nearly parallel to one another, and vertical, thus giving a section of the lower part of the mass somewhat the appearance that one associates with the coenœcium of *C. solidus*. The basal part of the mass being missing, many of the long tubes are broken across. Curved septa occur at irregular intervals in the basal parts of the longest tubes, reducing the inhabited part of the tube to 20 mm. or less.

On comparing with typical material of *C. nigrescens* one is struck by the remarkable length and thinness of the lip of the peristomial tube; the length of the lip is frequently as much as 4·5 mm. The average internal diameter of the tubes of the coenœcium is 1·0 mm., the diameter near the ostium is 1·2 to 1·4 mm. Some of the blind ends of the tubes are much more bulbous than those of the type material dredged by the "Discovery" (11), and have an internal width of 1·7 mm.

The lip of the peristomial tube being unilateral, the thickness of the tube on the side on which the lip is situated is greater than that of the opposite side, and this thickening can be traced down the side of the tube for a considerable distance into the interior of the common mass of the coenœcium, even occasionally as far as 20 mm.

The peristomial tube itself, not including the lip, is short, the distance from the lowest part of the ostial aperture to the general surface of common coenœcial substance being only 1 or 2 mm.; but at the three growing apices of the colony the distance is as much as 4 mm., that is to say, the intervals between the bases of the peristomial tubes have not yet been filled up with common coenœcial substance to the same extent as in the older parts of the colony. The coenœcial substance is fairly free from inclusions, but there can be recognised a few minute sand-grains and a number of irregular murky bodies that seem to be decalcified Foraminifera. There are also in the coenœcial substance a considerable number of extremely minute cruciform crystals that disappear when a piece of the coenœcium is transferred from alcohol to water, and may be presumed to have developed since the specimen was removed from the sea.

The zooids are black, and of the same size as those of typical material obtained by the "Discovery" (11). The arms are mostly fourteen in number, and the axes have the characteristic double black band running longitudinally. Of interest, as bearing upon the question of the disappearance of the pigment in imperfectly preserved material, dealt with at some length in the report on the British Antarctic ("Terra

Nova") Expedition, and in the section of the present report dealing with *C. solidus*, it is to be noted that in the serial sections of a zooid of the present material, cut transversely to the length, the arm-axes towards the outer side of the bunch show the double black mass distinctly, but those in the middle of the bunch do not; the preservative fluid apparently did not reach the latter in time to prevent the dissolution of the pigment.

The majority of the zooids seem to be young males. The mean diameter of a transverse section of the middle part of the notochord is in one zooid 0·033 mm., and in another 0·050 mm. Many buds are found, and of all stages; one fairly old bud has as many as 12 arms, which show the first appearance of the two rows of tentacles.

Cephalodiscus solidus.

(Plate VII, Figs. 3–5.)

Cephalodiscus (*Orthœcus*) *solidus* Andersson (2).

Colony not branching, in the form of a bulky mass or cake, measuring up to 250 or 300 mm. across, and 100 mm. high; the mass consisting of closely set, vertically disposed tubes of uniform diameter, each with an ostium at the upper end, and terminating blindly below; the tubes pale brown, united, except for a short distance at their upper ends, by common coenœcial substance, which may contain sand-grains, fine sponge-spicules and diatoms. The common coenœcial substance moderately firm, like that of *C. nigrescens*, not soft and spongy like that of *C. densus*. Upper end of each tube produced on one side into a short, thick, upright lip. Tubes in the middle of the colony measuring up to 100 mm., those at the sides shorter; width of cavity of tube about 1·2 mm.; near the ostium—1·4 mm., in narrowest parts—1·0 mm. Zooids—length from free ends of the arms to the end of body of a fairly extended zooid—4 to 5 mm.; length from bases of arms to end of body—3·0 to 3·5 mm.; width of body—1·0 mm. Colour (of preserved zooids), blackish; but colour of zooids removed from their tubes and preserved in 70 per cent. alcohol, not kept in the dark, fading to raw umber or yellow ochre. Arms usually eight pairs, axes not known to possess the two black bands seen in arms of *C. nigrescens;* no end-swellimgs with refractive beads. Male and female zooids and hermaphrodites (with one ovary and one testis) occurring in the same colony. Testes long. Free ova—0·9 by 0·7 mm., not stalked. Buds many to each zooid, up to fourteen.

Material of *Cephalodiscus solidus* was obtained from Station II (Lat. 66° 55′ S.; long. 145° 21′ E.; 318 fathoms; temperature 1·84° C.; 28th December, 1913), and consists of five colonies of approximately uniform size, much smaller than the type material of *C. solidus* obtained on the Swedish Expedition (2). The tallest colony (Plate 2, fig. 5) is roughly conical in shape, with a height of 40 mm., and a base of 60 mm., whereas the largest of the Swedish Expedition was a roundish cake, 100 mm. high and 300 mm. across (2, p. 11).

The largest colony, which for convenience of subsequent reference may be termed Specimen A, was subjected to a critical examination, and a vertical slice of a thickness of 10 mm. was cut from the middle of it in order to study the course of the tubes. A photograph of the section is given in Plate VII, fig. 3, and a diagrammatic representation of it in text-figure 2. The longest tubes (30 mm.) are those that reach the summit of the cone; the tubes seen on the left of fig. 3 are about 16 mm. long, and are set obliquely, those on the right are more vertical, and measure about 9 or 10 mm. The appearances suggest that the part on the right is the growing edge of the colony, although the zooids found in the tubes of that part cannot be recognised as younger than those in the longer tubes of the colony.

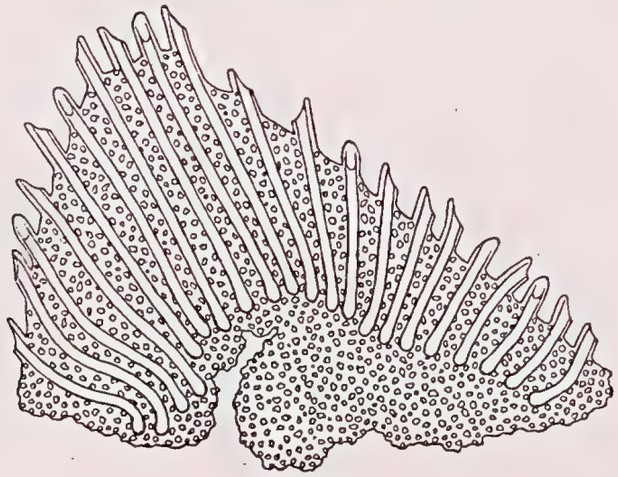

Fig. 2.

Text-fig. 2.—*C. solidus;* diagrammatic representation of a vertical section through the middle of a colony—Specimen A; Station II; × 1¾. Compare with the photographic reproduction of the same slice in Plate VII, fig 3. The tubes are the cavities occupied by the zooids; the irregular, hollow marks between and below the tubes represent sand-grains.

The cavity of each tube has a fairly uniform diameter of 1·00 to 1·05 mm., unless the tube is contracted and wrinkled, as it frequently is in certain parts. The blind ends of the tubes are very slightly dilated (1·1 mm.), and show septa. Some of the tubes have curved septa along their course, and not solely at the blind end. The substance of which the tube is composed is very thin and tough; it consists of numerous extremely thin layers, and is of a darker tint than the common coenœcial substance.

Each tube has an ostium at the upper end, and the free extremity of the tube is continued on one side into a short blunt lip, closely resembling that of *C. nigrescens*. The situation of the lip with reference to the middle and peripheral parts of the colony is very inconstant; the lip may be on the side of the tube nearest the summit of the colony, on the side remote from the summit, or on one of the two sides that are radially disposed with reference to the colony as a whole (text-fig. 2).

The part of the tube that projects beyond the general surface of the colony, the peristomial tube, is from 4 to 6 mm. in length, measuring to the end of the lip.

A peristomial tube consists of a tough, dark-coloured lining, a continuation of the "tube" of the deeper part of the colony, surrounded by paler substance, which is thicker on the side where the lip is than elsewhere. The external diameter of a peristomial tube is about 2·0 mm. The internal diameter near the ostium is about 1·05 to 1·10 mm. A peristomial tube seen from the side shows the layers of growth, running around the tube and up into the lip. The layers are distinct near the extremity, but they fade away below, and at the general level of the surface above which the peristomial tubes project the substance external to the dark-coloured tube-lining merges into the soft, colourless common coenœcial substance of the colony.

A feature of interest seen in material of *C. solidus* at the British Museum (Natural History) obtained at Station 94 on the Swedish South-Polar Expedition is that certain tubes of the coenœcium, still inhabited, are sealed up by a little circular operculum of coenœcial substance set transversely across the ostium. Being transverse to the axis of the tube, the disc is level with the lowest part of the opening, but on the opposite side of the ostium it is some little distance from the extremity of the lip. It is loosely attached at its edges, and is readily removable, and it is evidently only employed by the zooid as a temporary means of closing the tube. In the material of the Australasian Antarctic Expedition there are no precise equivalents of these discs, but some of the tubes have a small quantity of very soft coenœcial substance choking up the ostia. In both cases it may be that in the unnatural conditions prevailing from the time that the colony was caught in the trawl up to the time when it was dropped into the fixing fluid, the zooids made an effort at self-preservation by a rapid secretion of coenœcial substance at the mouth of the tube. Closed ostia have already been noticed in the case of *C. nigrescens* (11, p. 22; plate 4, fig. 13), but in those cases the tubes were empty and in basal parts of the branches; a general strengthening of the uninhabited basal part of the colony was apparently in progress, and the ostia became closed in the general deposit of new coenœcial material.

In plate VII, fig. 4, is shown the top view of a rather hemispherical colony (Specimen B); the height is about 35 mm. and the greatest width 43 mm.

In four of the five colonies obtained, the common coenœcial substance that occurs between the tubes, and consolidates the whole into a rather firm mass, is densely impregnated with fine, colourless sand, and is continued as a basal layer or lump below the level of the blind ends of the tubes (text-fig. 2). The only other inclusions besides the sand-grains are some pale brown sandy tubes, ranging from 4 to 9 mm. in length, and from 0·4 to 0·8 mm. in external width. Mr. C. D. Sherborn has been good enough to examine these, and informs me that they are the tubes of arenaceous Foraminifera, probably some species of *Rhabdammina*.

One of the colonies (Specimen E) is much less sandy than the others, and is more squat in shape; it differs, moreover, in that the lower ends of the tubes project

freely below the general under-surface of the coenœcium, some of them to the extent of 10 mm. These free blind ends are mostly collapsed and wrinkled, in a manner suggesting that the distortion has occurred subsequently to the separation of the colony from the sea-bottom. The under surface of this colony is in the preserved state deeply concave, but the probabilities are that in natural conditions it was more or less flat, and that the freely projecting, blind parts of the tubes were lodged in a substratum of mud or fine sand which has not been agglutinated and incorporated into the coenœcium. The sea-bottom at Station II is stated by Mr. J. G. Hunter, the Biologist of the Expedition, to be " thick ooze," but since the four sandy colonies and the single non-arenaceous colony were obtained from the same Station, it is not easy to account for their differences, unless by the supposition of local differences in the sea-floor.

The non-arenaceous, leathery colony, if spread out, would have a superficial area of 75 by 40 mm.; it is not more than 15 mm. high in the middle, not including the parts of the tubes that project above and below. On one side it spreads out into a thin film of common coenœcial substance, transparent and not more than 1 mm. in thickness, with a few scattered tubes projecting 6 to 10 mm. below the surface, and rising about 4 to 6 mm. above the surface, some vertically, others obliquely directed towards the highest part of the colony. In the thickest part of this colony the peristomial tubes attain a length of 8 mm., measured up to the extremity of the lip; in the four other colonies they rarely exceed 6 mm.

So far as the zooids are concerned the material is not well preserved. The method of preservation is not stated, but the material is now in alcohol, and was probably fixed in that fluid. Zooids found in the deep parts of the tubes are not in a suitable condition for investigation; they are but a black powdery mass. Disintegration had evidently set in before the preservative fluid had diffused down the tube.

In the case of future expeditions it would be well, on dredging specimens of *Orthœcus* or *Idiothecia*, to extract some of the zooids immediately, and to fix them by modern preservative methods. In the case of species of *Demiothecia* such precautions, though desirable, are not so essential; it is remarkable how well-preserved are the zooids of *C. dodecalophus* obtained on the " Challenger " Expedition.

Zooids of the present material that are found in the upper parts of the tubes are sufficiently well-preserved to enable the following points to be made out. They agree in size with those of *C. solidus* described by Andersson (2, p. 11), who puts the total length at 4 to 5 mm. One zooid with arms in a state of extension measured 6·6 mm. from the tips of the arms to the cæcal end of the body, 4·5 mm. from the bases of the arms to the end of the body, and 0·9 mm. across the body. In six other zooids the corresponding measurements were :—6·0, 3·9, 0·9; 5·1, 3·4, 0·9; 5·0, 3·6, 0·8; 4·6, 3·1, 0·8; 3·7, 2·4, 0·8; 3·2, 1·6, 0·8.

Although most of the zooids in the coenœcium of Specimen A are males, with a long testis and a shorter one, two zooids were found having each two ovaries; it is

established, therefore, that in this material male and female zooids occur in tubes of the same colony. No hermaphrodite individuals were found. The ovaries are about three times as long as they are broad, and have the form of an elongated pear.

The shield of full-grown zooids is roughly circular in outline, and calls for no special comment. There are eight pairs of arms, of the same uniform blackish, or dark greenish brown tint as the rest of the zooid. When mounted in dilute glycerine the depth of colour is slightly reduced, and the more transparent parts show of a raw sienna colour. The epithelial cells of the neural surface of the arm-axis are taller than those of the aponeural, grooved surface, but they have not the bloated and swollen appearance of those in the material of the Swedish Expedition (Andersson, 2. pl. 3, fig. 10), so that one rather suspects that in the latter material the size of the cells is to some extent due to a swelling caused by the fixing reagent employed (corrosive sublimate acetic acid alcohol). The fixing reagent of the material of the Australasian Expedition at present under consideration is presumed to be alcohol alone (*supra*).

It is singularly difficult in badly preserved zooids to distinguish between the arms of *C. solidus* and *C. nigrescens*. The two species, although relegated to different sub-genera on account of coenœcial differences, are very closely allied. The zooids in both are blackish, of approximately the same size, and the internal structure is practically identical; the only difference that one can point to with any degree of confidence is that in *C. solidus* the arms are mostly sixteen in number, whereas in the great majority of zooids of *C. nigrescens* they are fourteen.

In well preserved zooids of the latter species there are clearly recognisable in the arms a pair of rather broad black bands, separated by a narrow pale band, extending along the axis of the arm, and running together into a single band at the tip. The pigmented epithelium of these bands consists of tall cells, and is confined to the neural surface of the arm-axis; a few smaller pigment-cells are to be seen scattered along the distal halves of the tentacles of the arms.

In typical material of *C. solidus* from Station 94 of the Swedish South-Polar Expedition there is tall epithelium on the neural surface of the arm-axis, with just a suspicion of black pigment; the material is well preserved, and was mercurially fixed, as above explained, and it may be that the fixing fluid has had the effect of swelling and bleaching the tall pigmented cells, much in the same way as picric acid does the pigment-cells in *C. nigrescens* (11, p. 25). There is no indication that these tall cells of *C. solidus*, if pigmented, were disposed in the form of two longitudinal bands, but the possibility is not excluded.

In badly preserved, alcohol-fixed material of *C. nigrescens* the paired black band on the arm-axis is not distinguishable, but the whole arm, indeed the whole zooid, is stained a uniform black tint. If the arms of such a zooid are dissociated and soaked for three hours in weak Eau de Javelle (1 in 30), a general and uniform bleaching takes

place; the paired black band does not reappear. The jet-black tint of the arm (axis and tentacles alike) gradually gives place to a deep greenish brown,* then to a pale brown, and finally the arm becomes colourless. The arms of the zooids of the specimens of *C. nigrescens* supposed to have been dredged by the "Erebus" and "Terror" in 1841 or 1842 (13) are uniformly black in colour, and although the coenœcial characters of the material are so obviously those of *C. nigrescens*, I was not a little puzzled by the failure to discern the paired black band of the arm-axis.

A recent inspection of abundant material obtained on the British Antarctic ("Terra Nova") Expedition shows that different portions of material of *C. nigrescens* from the same Station, and presumably brought up in the same trawl, may show differences in the colour and condition of the arms. From one Station, for instance, a very large amount of *C. nigrescens* was obtained. Some of it was fixed and preserved in formalin solution, and some in alcohol. In the formalin-fixed material and in some of the alcohol-fixed material the paired black band of the arm-axis is well marked, and the other parts of the arm are pale; but in some of the alcohol-fixed material the zooids are in a very poor condition, and the arms are stained of a uniform black tint. Why there should be this difference between the two lots of alcohol-fixed material is difficult to comprehend; the only suggestion that I can offer is that the amount of material brought up in the trawl was so great that a considerable time elapsed before the last portions of it received attention, and that the badly preserved alcoholic material consists of some of the pieces of colony that were practically dead before they were placed in the spirit. The question has its bearing upon the zooids of *C. solidus* now under consideration, for they show a uniform black staining, and the general condition of preservation is not good.

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Whether, therefore, in living zooids of *C. solidus*, and in preserved material fixed by some other methods than those adopted on the Swedish and Australasian Expeditions, the arm-axes show a paired black band, must for the present be left undecided. No features of the arms beyond the difference in their number in the two species are sufficiently definite to be really trustworthy as a means of distinction, but a study of a large number of zooids enables one to say that, on the whole, the arms of *C. solidus* are longer than those of *C. nigrescens*, the axis is rather narrower, and has a more slender and tapering extremity; but the distinction is not final, for arms of *C. nigrescens* in a state of extension can show a narrow axis, with tapering extremity (*e.g.* 11, pl. 5, fig. 24).

It is worthy of note that in material of *C. solidus* from the Swedish Station 94, now at the British Museum (Natural History), the zooids tend to become paler in time, presumably by the action of light, for the fading of the black colour is most marked in the zooids in the more superficial tubes, whereas those in the deeper parts of the colony remain dark in tint. The pigment in *C. solidus* and *C. nigrescens* is probably not identical

* Schepotieff has observed that Eau de Javelle turns the black pigment of *Rhabdopleura* greenish (Zool. Jahrb. Abth. f. Anat., vol. xxiii, pt. 3, 1906, p. 477).

with that in *C. gilchristi*, the zooids of which yield up their colour readily to the fixing and preserving fluids (3 p. 239). Reduction of black colour by the action of alcohol is also suspected in the case of *C. agglutinans* (6, p. 544).

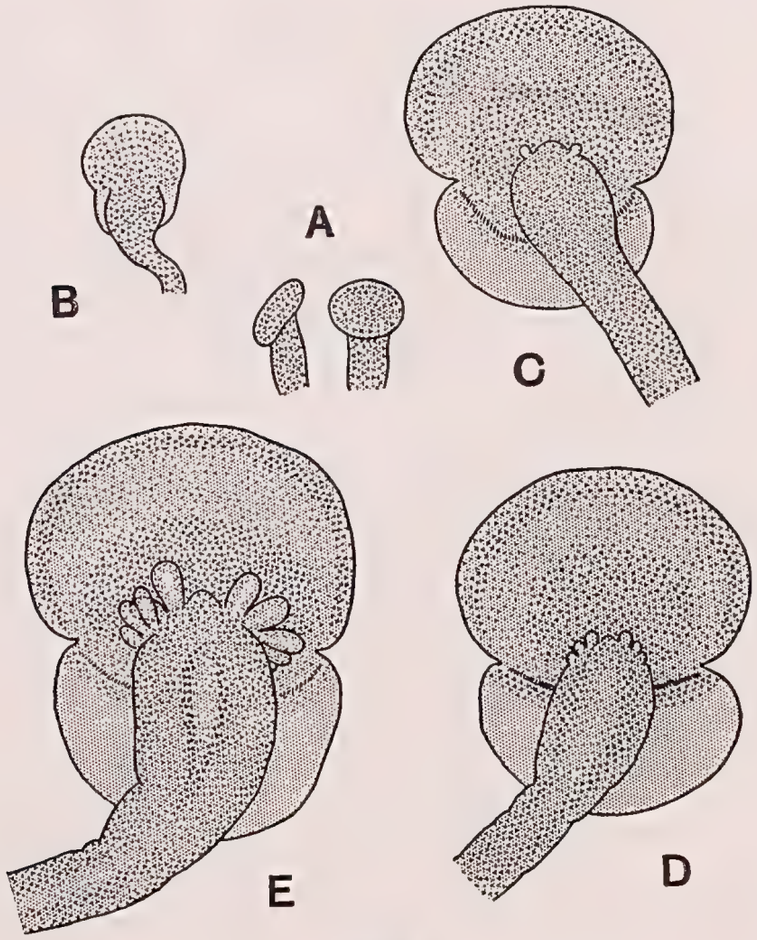

Fig. 3.

Text-fig. 3.—*C. solidus;* buds of material collected at Station 94 of the Swedish South-Polar Expedition of 1901-1903. (× 54).—A, two views of an extremely small bud; B, a bud showing first differentiation of the posterior lobe of the shield; C, a bud with the first pair of arms developing; D, a bud with three pairs of arms developing; E, a bud with five pairs of arms developing.

The buds are numerous, mostly from four to nine on each zooid; one zooid was found with as many as thirteen buds. Most of the buds found are of a stage a little younger than that shown in text-fig. 3, C. They show a fairly large shield, and no traces of arms, and they agree with the buds of the Swedish specimens of *C. solidus* in the late development of the arms, as well as in size, colour, and other respects. Since the Swedish material available furnishes a more complete developmental series than that obtained on the Australasian Antarctic Expedition, text-fig. 3 was drawn from selected buds of the type-material of *C. solidus* obtained from Station 94 of the Swedish South-Polar Expedition.

Cephalodiscus densus.

(Plate VII, fig. 1.)

Cephalodiscus (*Orthœcus*) *densus* Andersson (2).

Colony not branching, in the form of a bulky mass or cake, measuring up to 95 mm. across and 70 mm. high (Swedish Expedition material), and 130 mm. across and 100 mm. high ("Terra Nova" Expedition material); the mass consisting of closely set, vertically disposed tubes of uniform diameter, each with an ostium at the upper end, and terminating blindly below; the tubes sometimes straggling, not closely set, nor straight; the tubes united by very soft coenœcial substance for a part of their length, particularly near their bases, but in places standing free for a considerable proportion of their length. Ostium set transversely, rarely obliquely, to the end of the tube, the margin without lip, uniform, thin, sometimes with irregular external flanges. Tubes colourless, or pale brown, sometimes encrusted with sand-grains or diatoms; measuring up to 60 or 70 mm. in the middle of the colony, towards the edges gradually shorter; width of cavity of tube 1·0 to 1·2 mm., slightly greater near the ostia; external diameter of free part of a tube 1·6 mm. Zooids—length from free ends of the arms to end of body of a fairly extended zooid, 4 to 7 mm.; length from bases of arms to end of body—2 to 4 mm.; width of body—0·8 to 1·0 mm. Colour (of zooids preserved in alcohol) greyish white, ochreous, orange or brown. Arms usually 8 pairs; no end-swellings with refractive beads. Male and female zooids and hermaphrodites (with one ovary and one testis) occurring in the same colony. Testes long, elongate, pyriform. Free ova—0·8 by 0·7 mm., not stalked. Buds many to each zooid, from five to fourteen.

Material of *Cephalodiscus densus* was dredged from Station VIII (lat. 66° 8′ S., long. 94° 17′ E., 120 fathoms, 27th January, 1914). This material consists of a fragment of a large colony (pl. 2, fig. 1), and measures 55 mm. high and 80 mm. wide; it is in a ragged condition, and is poorly preserved so far as the coenœcial substance is concerned, although the condition of the zooids is very fair.

The tubes are about 30 to 50 mm. long, with an internal width of 1·1 mm., except near the ostium, where the width increases slightly. The ostial ends of the tubes are squarely truncated, without any lip. Some of the tubes are united side by side to within 2 or 3 mm. of the ostia, others have free portions up to 20 mm. in length. There are a fair number of small sand-grains embedded in the common coenœcial substance.

The colour of the zooids is pale—raw umber to cream colour. The zooids in the deeper parts are darker in colour (burnt umber), rather suggesting that exposure to light has caused the colour to fade in the case of the zooids more superficially situated. The zooids are smaller than those of the type of the Swedish Expedition (2), and an average of eight selected zooids yielded the following results :—total length 4·4 mm.; length from bases of arms to cæcal end of the body 2·0 mm.; width of body 1·0 mm.

The arms are mostly 16 in number, sometimes less. Although the piece of colony collected is so small, both males, females and hermaphrodites are found in it. One of the hermaphrodite zooids is of interest as having both ovary and testis in a fully ripe condition, and among the buds in the basal end of the tube from which the zooid was extracted was a free ovum, presumably extruded by the zooid in question. The ova measure 0·8 by 0·65 mm. Buds are numerous; one zooid was found possessing seven, and another eight buds.

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EXPLANATION OF THE PLATES.

Plate VI.

Figs. 1–4.—*Cephalodiscus hodgsoni* Ridewood; Stat. XII, Bottle G. Nat. size.

Figs. 5 and 6.—*C. hodgsoni* Ridewood; Stat. XII, Bottle E. Nat. size.

(Photographs by Mr. J. H. Leonard.)

Plate VII.

Fig. 1.—*Cephalodiscus densus* Andersson; Stat. VIII, Bottle D. Nat. size.

Fig. 2.—*C. nigrescens* Lankester; Stat. VIII, Bottle D. Nat. size.

Fig. 3.—*C. solidus* Andersson; Stat. II, Bottle B. Nat. size. Vertical section through the colony of which the external view is shown in fig. 5. A diagrammatic representation of this section is shown in text-fig. 2.

Fig. 4.—*C. solidus* Andersson; Stat. II, Bottle B. Nat. size. Top view of a hemispherical colony, Specimen B.

Fig. 5.—*C. solidus* Andersson; Stat. II, Bottle B. Nat. size. Side view of a conical colony, Specimen A. A median section of this colony is shown in fig. 3.

(Photographs by C. Butterworth.)

INDEX.

	PAGE.
æquatus CEPHALODISCUS	6
agglutinans CEPHALODISCUS...	6
CEPHALODISCUS	5, 7, 8
DEMIOTHECIA	8
densus CEPHALODISCUS	6, 7, 22
dodecalophus CEPHALODISCUS	5, 6
gilchristi CEPHALODISCUS	6
gracilis CEPHALODISCUS	5
hodgsoni CEPHALODISCUS	6
IDIOTHECIA	8
indicus CEPHALODISCUS	6
inæquatus CEPHALODISCUS	6
levenseni CEPHALODISCUS	5
nigrescens CEPHALODISCUS	5, 7, 13
ORTHŒCUS	8
rarus CEPHALODISCUS	6
sibogæ CEPHALODISCUS	5
solidus CEPHALODISCUS	6, 7, 15

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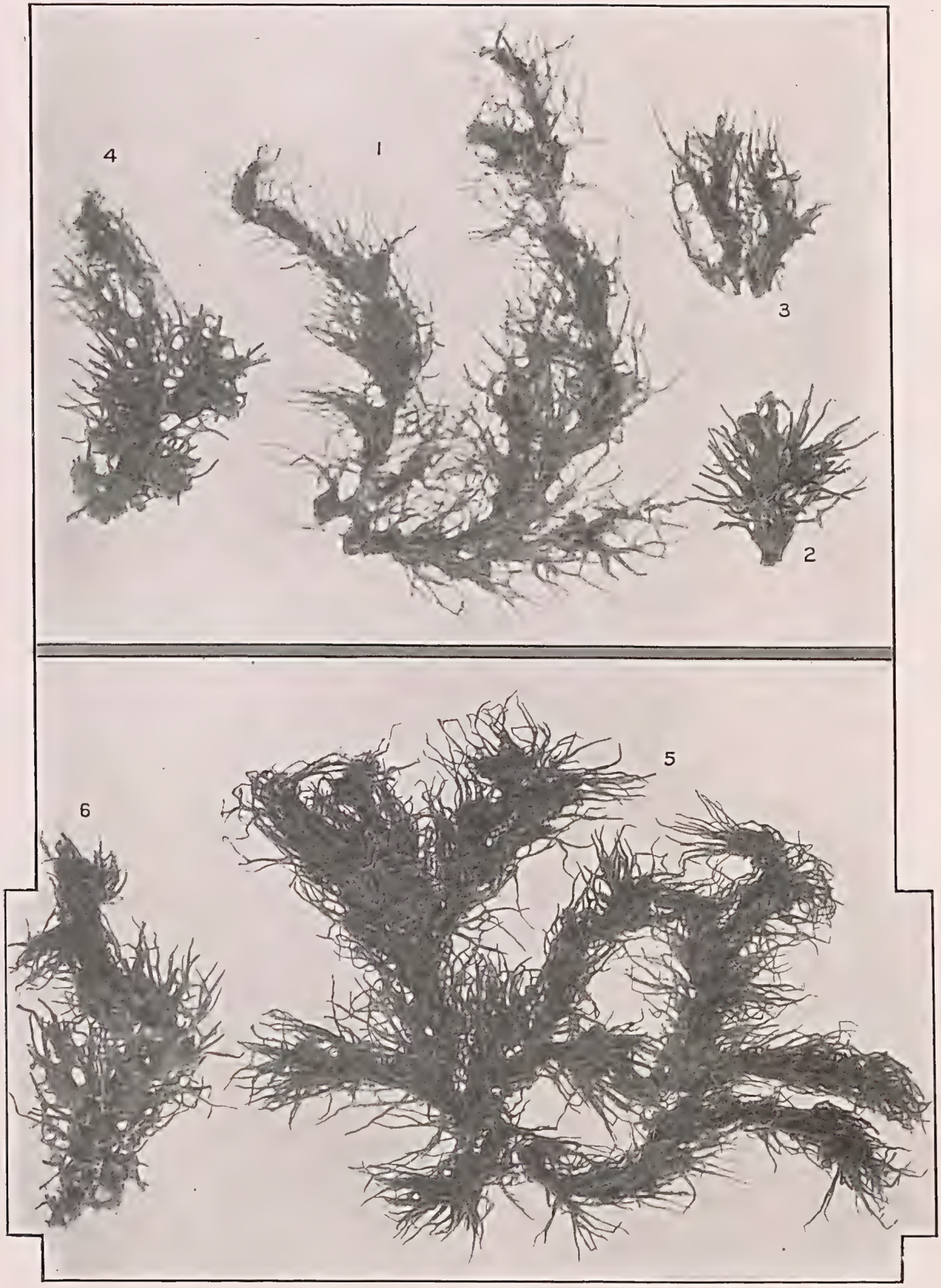

CEPHALODISCUS HODGSONI. Nat. Size.

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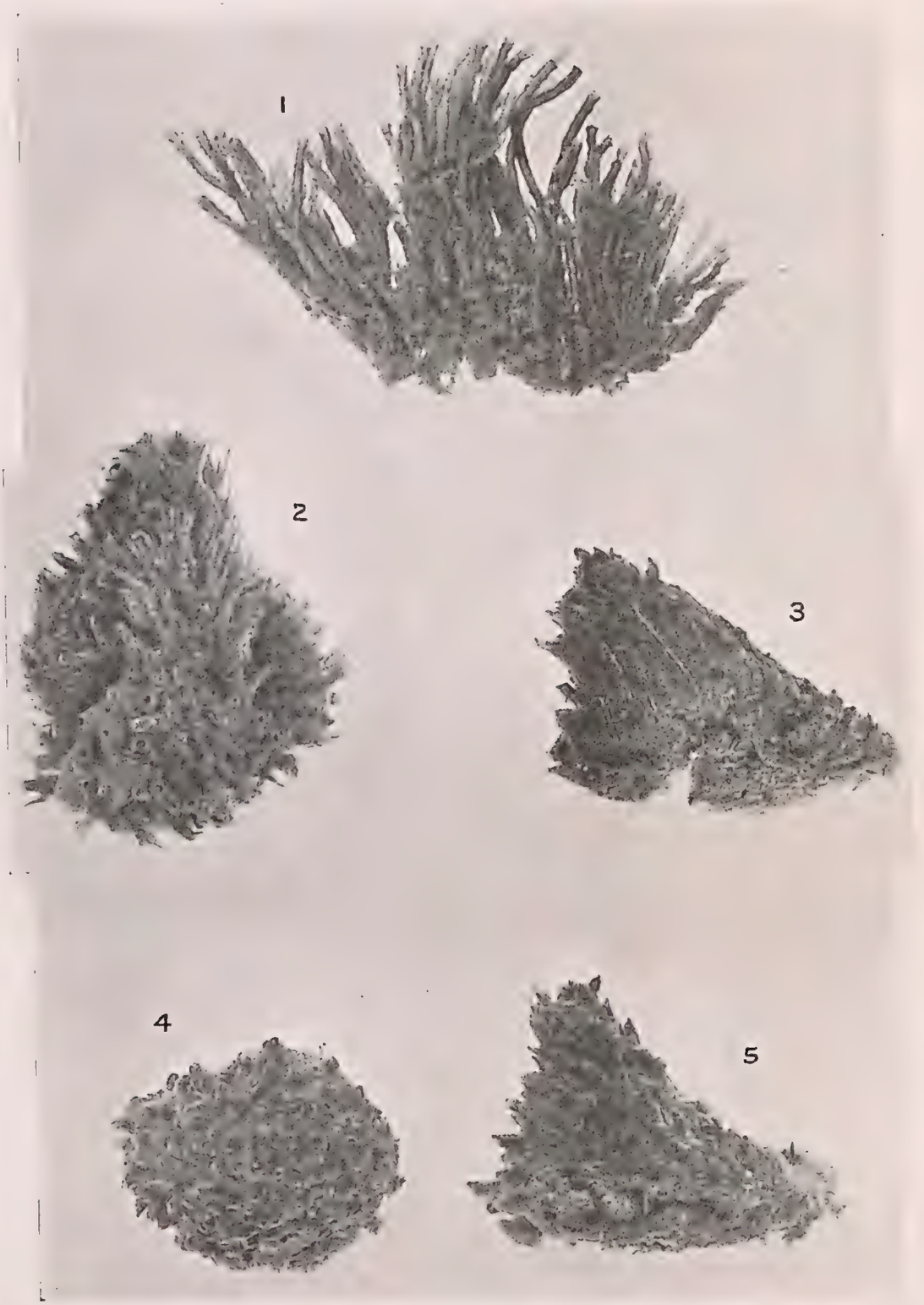

CEPHALODISCUS DENSUS (Fig. 1), C. NIGRESCENS (Fig. 2), C. SOLIDUS (Figs. 3-5). Nat. Size.

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1911-14.

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SCIENTIFIC REPORTS.

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VOL. III. PART 3.

ASCIDIÆ SIMPLICES.

BY

SIR WILLIAM A. HERDMAN, C.B.E., F.R.S., UNIVERSITY OF LIVERPOOL.

WITH SIX PLATES.

PRICE: FOUR SHILLINGS.

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CONTENTS.

PAGE

Introduction 5

Description of the Species 9

Family Molgulidæ 9

Family Halocynthiidæ 17

Family Ascidiidæ 28

Family Clavelinidæ 30

Explanation of Plates 31

Index 35

Plates.

TUNICATA.

ASCIDIÆ SIMPLICES.

THE SIMPLE ASCIDIANS.

By Sir William A. Herdman, C.B.E., F.R.S., Emeritus-Professor of Natural History in the University of Liverpool.

With Six Plates.

INTRODUCTION

The collection of Tunicata obtained by the Australasian Antarctic Expedition (1912–14), under the leadership of Sir Douglas Mawson, in the S.Y. "Aurora," comprises about 360 specimens belonging to about forty species, nearly equally divided between Simple and Compound Ascidians. Twenty species of Simple Ascidians, of which five seem new to science, are described in the present Report.

These specimens were collected at far southern localities in the region between Tasmania and Wilkes Land, the antarctic quadrant lying between 90° and 180° E. longitude. Shore collections were made (by Mr. H. Hamilton) at Macquarie Island in S. lat. 55°. Various shallow-water dredgings, down to 60 fathoms, were made, sometimes through channels in the ice, in Commonwealth Bay, Adelie Land (S. lat. 67°, E. long. 142° 36′) by Mr. J. G. Hunter, Biologist to the Expedition. During the winter cruise of 1912, Professor T. T. Flynn dredged some of the specimens from 65 fathoms, off Maria Island, Tasmania; and, finally, large collections were made at twelve stations in S. lat. 63° to 66° along the coast of Wilkes Land between E. long. 92° and 145°. The official particulars of these stations are as follows :—

Station.	Date.	Locality.	Depth.	Temperature	Nature of bottom.
			fathoms.		
I	22/12/13	Lat. South 66° 50′, Long. East 142° 6′ (In Commonwealth Bay, Adelie Land).	354	—1·85°C.	Small amount of ooze.
II	28/12/13	Lat. South 66° 55′, Long. East 145° 21′	318	—1·84°C.	Ooze.
III	31/12/13	Lat. South 66° 32′, Long. East 141° 39′	157	—1·62°C.	Ooze with few small rocks.
IV	2/1/14	Lat. South 65° 48′, Long. East 137° 32′	230	—1·4°C.	Ooze.
V	6/1/14	Lat. South 64° 34′, Long. East 127° 17′	1,700	—0·32°C.	Ooze.

Station.	Date.	Locality.	Depth.	Temperature	Nature of bottom
			fathoms.		
VI	14/1/14	Lat. South 63° 13½′, Long. East 101° 42′.	870	—0·23°C.	Ooze.
VII	21/1/14	Lat. South 65° 42′, Long. East 92° 10′	60	Not taken	Few small rocks and red algæ, no ooze.
VIII	27/1/14	Lat. South 66° 8′, Long. East 94° 17′	120	Not taken	Few small granitic rocks; no ooze.
IX	28/1/14	Lat. South 65° 29′, Long. East 95° 27′	240	+1·38°C.	Small amount of ooze and granitic rock.
X	29/1/14	Lat. South 65° 6′, Long. East 96° 13′	325	—1·65°C.	Ooze.
XI	31/1/14	Lat. South 64° 44′, Long. East 97° 28′	358	Not taken	Ooze.
XII	31/1/14	Lat. South 64° 32′, Long. East 97° 20′	110	Not taken	Rock with very small amount of ooze.

Most of the collection was preserved in 70 per cent. alcohol, incisions being made in the outside tunics of the larger animals, and in some cases formaline was used. In most cases the specimens were found to be in a satisfactory condition for identification; some few that were not (such as some of the more massive Simple and Compound Ascidians) may have been dead when collected, as I have suspected to be the case in previous collections from arctic and antarctic seas when the more delicate internal tissues were decomposed, although the tougher exterior of the animal seemed normal.

The present collection forms no exception to the general rule in regard to series of arctic and antarctic Tunicata, which I have had occasion to point out in previous reports, viz., that most of the species are of large size, and so a very bulky collection may consist mainly of a large number of individuals belonging to comparatively few species. The contrast in both these respects between this circumpolar Tunicata fauna and that from the tropical and sub-tropical parts of the same ocean, as shown, for example, by Professor Stanley Gardiner's "Sea-Lark" collections (now in my hands), and my own collection of Ceylon Tunicata, is most marked. The warmer Indian Ocean, in contrast to the colder antarctic region south of it, shows a large number of species represented each by few individuals of small size.

The occurrence, in a single haul of the dredge from cold polar waters, of great numbers of some one or two large species has been recorded in the case of various groups of more or less sedentary animals (*e.g.*, Sponges, Alcyonaria, Echinoderms, &c.), and one of the most striking features of the present collection is the gigantic *Ascopera mawsoni*, of which (a collector's note informs us) about a thousand specimens came up in the dredge at Station XII, off Wilkes Land, from a depth of 110 fathoms.

As would be expected, there are some species that are common to most antarctic collections, and which are evidently abundant and characteristic members of the

circumpolar marine fauna, such as *Halocynthia setosa*, *Styela lactea*, and *Holozoa cylindrica*. I give here a table showing a list of the species in the Australasian collection and their occurrence in some of the other more important Antarctic collections :—

Species.	Challenger.	Scotia.	Discovery.	Charcot.	Valdivia.	Gauss.	Belgica.	South Georgia.	Southern Cross.
Ascopera mawsoni, n....	(?)	...	...	...	...	×	...	...	...
Bathypera splendens ...	...	...	...	×	×	×	...	...	...
Molgula lutulenta, n. ...	...	...	...	...	...	...	...	...	...
Molgula concomitans ...	...	...	×	...	...	...	...	...	...
Molgula euplicata, n. ...	...	...	...	...	...	...	...	...	...
Boltenia antarctica ...	...	...	...	...	...	...	×	...	...
**Microcosmus spinifer* ...	...	...	...	...	...	...	...	...	...
**Rhabdocynthia draschii*	...	...	...	...	...	...	...	...	...
Halocynthia discoveryi...	...	...	×	×	...	×	...	...	...
**Halocynthia cerebriformis*	×	...	...	...	...	...	...	...	...
Halocynthia setosa ...	...	×	×	×	...	×	...	...	...
Halocynthia flynni, n....	...	...	...	...	...	...	...	...	...
Styela lactea (?*verrucosa*)	×	×	...	×	×	×	...	×	×
Styela subpinguis, n. ...	...	...	...	...	...	...	...	...	...
**Styela personata* ...	...	...	...	...	...	...	...	...	...
Styela insinuosa ...	...	...	...	×	...	...	...	...	...
**Polycarpa rigida* ...	×	...	...	...	...	...	...	...	...
Ascidia challengeri ...	×	?	...	?	×	?	...	...	...
Ascidia placenta ...	×	...	...	...	...	×	...	...	...
Corella dohrni	...	...	?	?	...	?	×	?	...

The five species marked n. are described as new to science.

The (?) to *Ascopera mawsoni* in the "Challenger" column is to indicate that the closely related *Ascopera gigantea* was obtained by the "Challenger" Expedition.

The ? to *Ascidia challengeri* in the "Charcot" column is to indicate that the closely related *Ascidia charcoti* may be the same species.

Those species marked with a star * are also recorded in the Catalogue of the Tunicata in the Australian Museum, Sydney, N.S.W.

These various expeditions worked in Antarctic and Sub-antarctic waters as follows :—

"Challenger" Expedition, Kerguelen Island and southwards, in 1874; "Southern Cross," in 1898–1900, Cape Adare, S. Victoria Land, 90°–180° E.; "S. Georgia" includes the Hamburg Museum collections from the Falklands and S. Georgia and Magellan; "Belgica," in 1897–9, to 71° S., near Graham Land; "Valdivia," in 1898–99, to north of Enderby Land (63° S.), and East of Bouvet Island; "Scotia," in 1902–4, Falklands and South Orkneys; "Discovery," 1901–4, McMurdo Bay, Coulman Island, east end of "Barrier"; "Gauss" Süd-Polar Expedition, 1901–3, from Simons' Bay by Kerguelen to Kaiser Wilhelm II Land; "Charcot," first and second French Expeditions, 1903–5 and 1908–10, south of Cape Horn, to 70° S., and S. Shetlands towards Adelaide Island; and "Aurora," Mawson, 1912–14, Tasmania to Wilkes Land.

Each of these expeditions, of course, obtained other species which are not on the "Mawson" list, and therefore are not recorded on the preceding table. Every succeeding expedition still adds considerably to our knowledge of the large Antarctic Tunicate fauna, and no doubt it is because of the enormous difficulties in collecting

in these polar seas that some of the collections are so small and probably do not represent adequately the fauna present in the region explored. In many cases only one or two specimens have been obtained of species which may really be abundant in some part of the locality. Previous expeditions from the "Challenger" onwards obtained only single individuals of the genus *Ascopera*, and the "Mawson" expedition in one successful haul from 110 fathoms brought up a thousand specimens.

In addition to the five species described as new in this Report, the remaining fifteen species of the collection have enabled me in nearly all cases to contribute something to the knowledge either of the characters or of the affinities or the distribution, and to add some figures of structures which in my opinion were either required for the diagnosis of the species or differed somewhat from those already published. One of the most interesting and remarkable forms, which I have illustrated fully on Plate IX, is not a new species, but the handsome deepwater *Bathypera splendens*, Michaelsen, which had previously been very rarely found, and of which the "Mawson" Expedition obtained five specimens, at two localities far south.

The other species are of a more ordinary character belonging to well-known genera, and all falling into one or another of the three old-established families: Molgulidæ, Halocynthiidæ and Ascidiidæ.

DESCRIPTION OF THE SPECIES.

Family MOLGULIDÆ.

Ascopera mawsoni, *n. sp.*

(Plate VIII, figs. 1–6.)

Body pear-shaped, on a short stalk ending in a bunch of fibres embedded in mud. Branchial and atrial apertures anterior, large and open, measuring 3 to 5 cm. across. Colour (after preservation) light gray, said to be " pale red " when alive.

Test very thin and paper-like, fairly tough and smooth, but bearing many slender tag-like processes from 1 to 2 mm. in length, and placed about the same distance from one another: smaller intermediate papillæ are also present (see pl. VIII, fig. 3).

Mantle thin and gelatinous, with a few muscle-bands mainly on the right side; occupying only about half the space inside the test. Branchial siphon larger than atrial. A narrow gelatinous cord runs from the posterior end of the mantle down to the test at the base of the stalk.

Branchial sac exceedingly delicate, with seven large folds on each side. Internal longitudinal bars wide and distinct (fig. 4), but transverse vessels irregular and inconspicuous, the stigmata being for the most part not arranged in definite rows or series (fig. 5).

Dorsal Lamina a plain membrane.

Dorsal Tubercle very large and prominent, opening directed posteriorly, both horns coiled inwards with about two and a half turns (fig. 6).

Tentacles compound, much branched, large and small alternately, eight of each, largest measuring about 2·5 cm. Between these sixteen lie other very much smaller ones (fig. 6).

Viscera consisting of alimentary canal and gonads on left side towards dorsal edge, and renal organ and remaining gonads on right side of body.

There are eight large specimens of this species in the collection, the largest measuring 32 cm. by 16 cm., the stalk being 8 cm. by 2 to 3 cm., but many more specimens were obtained (see below).

Locality.—Off Queen Mary Land, Station XII; 31st January, 1914; lat. S. 64° 32′, long. E. 97° 20′; depth 110 fathoms; bottom rock with very small amount of ooze. On same occasion a small specimen of *Holozoa cylindrica* was obtained floating, no doubt detached from the bottom. A very small specimen of

Ascopera (pl. VIII, fig. 2), which is probably a young *A. mawsoni*, was found in a bottle labelled "Dredgings, Commonwealth Bay, Adelie Land, 21st January, 1913."

The genus *Ascopera* was formed in 1882 for the reception of two new species of Molgulidæ of large size, dredged by the Challenger Expedition in 1874 at Station 150 (to the south of Kerguelen Island) from a depth of 150 fathoms. These two species were described as *A. gigantea* and *A. pedunculata*, and the present species is undoubtedly closely related to *A. gigantea*, but differs notably (1) in having small tag-like projections all over the test, and (2) in the much more regular shape and arrangement of the stigmata (compare fig. 5 with the figures in the Challenger report). These characters are seen in all the specimens of the present collection, and no transitions to the characters of the Challenger specimens are found. Consequently, I consider it justifiable to describe the present as a new species. At the locality in question—off Queen Mary Land—this species must be present in enormous abundance, as a note written by Mr. J. G. Hunter, the Biologist to the expedition, reads :—"Station XII yielded an immense number of specimens of a large stalked simple Ascidian—pale red, with thin test, averaging 8 to 9 inches long. There must have been nearly one thousand specimens of this large form."

The discovery of this new species, *A. mawsoni*, necessitates, however, a slight modification of the generic diagnosis of *Ascopera* as given in the Challenger Report. It is there stated that the test is free from tag-like processes. That is true of the Challenger species *A. gigantea* and *A. pedunculata*, but not of *A. mawsoni*. The omission of that minor character from the definition of the genus is, however, unimportant.

A much smaller species, *A. nana*, Herdman, probably belonging to this genus, was described in the Catalogue of Tunicata in the Australian Museum (1899) from specimens obtained at Port Jackson. An additional species of the genus, *A. bouvetensis*, Mchl., was described in 1904, by Michaelsen from the collection made by the "Valdivia" on the German "Tiefsee Expedition" of 1898–9. It was obtained from a depth of 439 m. to the east of Bouvet Island.

As *Ascopera mawsoni* is evidently, from the experience of Mawson's Expedition, present in enormous quantities in, at least, one locality far south, and probably in others also, it is remarkable that such a large and conspicuous form has not been reported by other Antarctic Expeditions.

The single small specimen of *Ascopera* obtained by Drygalski's ("Gauss") South Polar Expedition (1901–3), from 380 m., and described by Hartmeyer as a young *A. gigantea*, is in my opinion more probably a young *A. mawsoni*, although the papillæ on the surface of the test shown in Hartmeyer's pl. 45, fig. 4, do not resemble in shape and appearance the tags on my adult specimens of that species; but that difference may possibly be due to age and growth.

Finally, it is possible that, as Hartmeyer has suggested, my *Molgula longicaulis*, obtained in McMurdo Bay during the National Antarctic Expedition in the " Discovery " (1901–4), ought to be placed with other stalked forms in the genus *Ascopera* rather than in *Molgula*.

Bathypera splendens, *Michaelsen*.

(Plate IX, figs. 1–17.)

Halomolgula ovoida, Ritter, Univ. California Pub. Zool., (1907), 4, 1,

Pyura liouvillia, Sluit., Deux. Exp. Antarct. Franc. (1908–10), Tuniciers, p. 12 (1914).

Body globular, measuring about 3·5 by 3 cm., attached to coarse sand by a small area at posterior end, or by a short stalk of about 5 mm. The whole surface of the body covered with minute, regular, closely-placed, hard, pointed, calcareous papillæ, showing white against a dark-grey ground-work, and giving a characteristic ornamented appearance to the species (see figs. 1, 2, &c.)

Test thin, but tough and prolonged on the outer surface into most regularly arranged papillæ, containing calcareous spicules, which form a pattern, and extend over even the invaginated extension of the test which lines the branchial and atrial siphons. The characters of these compound papillæ can be best seen from the figures (figs. 6–11).

The branchial and atrial apertures are both bilabiate and slit-like (figs. 3 and 4), each about 5 mm. in length and placed with their long axes at right angles to one another, the branchial extending dorso-ventrally and the atrial laterally.

The base of both branchial and atrial siphons shows a well-marked fringe of white calcareous spicules projecting for several millimetres into the cavity, and marking the inner edge of the inflected test.

The branchial sac has six well-marked folds on each side, with twelve to sixteen bars on a fold and five or six in the interspaces (fig. 12). The character of the stigmata is shown in figures 13 and 14.

Dorsal lamina having its front portion fringed with long teeth or languets, sometimes forked at the free end (fig. 15), crossed by delicate ridges, three or four to each languet. The posterior part of the lamina is a plain membrane.

Tentacles twelve in number, of two sizes alternating, and generally with still smaller ones between. In the largest specimen examined there are many such smaller intermediate tentacles of various sizes, forming a continuous fringe.

Dorsal tubercle small, cordate, opening anterior with both horns turned inwards.

Viscera near the posterior end of the body, just inside the point of attachment. The alimentary canal extends along the posterior end of the left side. The narrow elongated gonad on the right side extends around the posterior end from the ventral to the dorsal edge. The gonad on the left side lies in the loop of the intestine (fig. 5), and also extends from the ventral to the dorsal edge of the posterior end of the body. Endocarps engorged with blood corpuscles (fig. 16), project from the inner surface of the mantle. The mantle also shows (fig. 17), ramifying over its muscle bundles a system of fine vessels having terminal enlargements engorged with corpuscles.

Localities.—

Station I, 22nd December, 1913, 358 fathoms; four specimens measuring respectively 5, 3·5, 3, and 2 cm. in greatest diameter. Two of these specimens have short stalks, about 5 mm. in length; the others are merely attached by the posterior end of the test.

Station VIII, 27th January, 1914, 120 fathoms; one specimen measuring 3·5 by 3 cm.

This is a very remarkable species, with a most characteristic, ornamental, appearance (see figs. 2, 3, 4, &c.). It was first found by the "Valdivia" expedition to the north of Enderby Land, at a depth of 4,636 m., and was described by Michaelsen in 1904 as the type of a new genus, *Bathypera*, in the family Molgulidæ. The "Gauss" expedition, in 1903, found six very young specimens off Kaiser Wilhelm II Land, in depths of 350 to 2,916 m., which Hartmeyer, in 1911, refers to Michaelsen's genus and species.

Hartmeyer, however, in 1909 (Bronn., v. iii, supp., p. 1328) had diagnosed *Bathypera* anew, under the family Molgulidæ, but omitted all reference to the characteristic appearance due to the clumps of calcareous spicules on the test.*

The second "Charcot" Expedition (1908–10) next obtained a specimen from the "Pourquoi Pas?" dredgings (no depth given), which Sluiter (1914) refers to the family Cynthiidæ (Pyuridæ), and describes as a new species under the name *Pyura liouvillia*. From Sluiter's figures and description there can be no doubt that the "Charcot" specimen belongs to, at least, the same genus as those of Michaelsen and Hartmeyer, and even probably to the same species, and yet he makes no mention of *Bathypera splendens*. In the meantime, Ritter in examining the ascidians collected by the "Albatross" off the coast of Southern California in 1904, found what is clearly a very closely-related, if not identical form, which he described in 1907 under the name *Halomolgula ovoida*, n. gen. et sp. He had 150 specimens at his disposal, dredged from 1,000 fathoms off the south of Point Conception, and from his full description

* Hartmeyer in "Bronn" (*loc. cit.*) recognises Ritter's genus *Halomolgula*, and points out that *Halomolgula* shows certain resemblances to *Bathypera*, but adds that the outstanding generic character of *Halomolgula* is the presence of these calcareous bodies in the test. But *Bathypera splendens* has these same calcareous bodies (see Michaelsen's original description), which character in fact is the outstanding resemblance which proves that *Halomolgula* is a synonyn of *Bathypera*.

and figures it is evident that he was dealing with Michaelsen's *Bathypera*, if not indeed with the species *B. splendens*. He gives the calcareous spicules projecting from the test as a diagnostic generic character of *Halomolgula*, and in their arrangement and in the appearance and most details of the internal structure his description and figures agree closely with our Antarctic species, and would clearly fall into the genus *Bathypera*. His *H. ovoida* has, however, nine folds on each side of the branchial sac, and for that and other reasons, such as the dorsal tubercle and the tentacles, I am inclined to consider the Antarctic form to be a distinct species from the Californian, which must, therefore, be named *Bathypera ovoida* (Ritter).

Ritter, then, quite independently of previous investigators, had come to the conclusion (like Michaelsen and Hartmeyer) that this remarkable form (*Bathypera* or *Halomolgula*), ornamented with calcareous spicules projecting from the test, was a Molgulid; and I can only suppose that Sluiter, in referring what is obviously the same species to the genus *Pyura* (a Cynthiid) was misled by the unusual position of the left gonad in the intestinal loop. The fact is that *Bathypera*, as the genus must be called, is in some respects a border-line form, and has the branchial sac of a Molgulid, combined with the visceral arrangement of some Cynthiids, but which may be found in both families. The lobes of the branchial and atrial apertures give no indication in either direction. It is true that the branchial aperture in *Bathypera splendens* does not show the characteristic six-lobed condition of the Molgulidæ, but, on the other hand, neither does it have the four lobes characteristic of Cynthiidæ. In that respect it is an exceptional form in either family—and similarly for the bilobed atrial aperture. Other exceptional forms in regard to the character of the apertures are well known in both families. The branchial sac is, however, characteristically Molgulid. The stigmata are not arranged in rows or straight series, as in Cynthiidæ, but are more or less curved, and in places may be coiled to form infundibula. The appearance of the mantle also, in the body after the removal of the test (fig. 5). is that of a Molgulid.

There are a few minor discrepancies between Sluiter's description of his "*Pyura liouvillia*" and the "Mawson" specimens now before me, the chief of which is that in dealing with the papillæ ("petites protubérances") he makes no mention of the remarkable and characteristic calcareous spicules which occupy these papillæ, give them their white colour, and have the curious appearances which I have described and figured, and which are also recognised by Michaelsen, Hartmeyer, and Ritter. Possibly some accident in the preservation may have led to their disappearance. Otherwise Sluiter's description and figures leave no doubt that his specimens are so far identical with ours that they belong at least to the genus *Bathypera*, if not, indeed, to the same species, *B. splendens*.

The *Bathypera* "forms" (whether one or two species) have now been found as follows:—

"Valdivia" Expedition (Michaelsen), north of Enderby Land, 2,534 fathoms.

"Albatross" (Ritter), off coast of California, 1,000 fathoms.

"Gauss" (Hartmeyer), off Kaiser Wilhelm II Land, 191–1,592 fathoms.

"Pourquoi-Pas ?" (Sluiter), "Dragage IX (No. 108), Dragage XVIII (Nos. 835, 840)." No depths given.

"Mawson" (Herdman), off Adelie Land, and off Wilkes Land, 120 and 358 fathoms.

I think it probable that Ritter's Californian specimens belong to a distinct species, *Bathypera ovoida* (Ritter) and that all the rest are *B. splendens*, Michaelsen.

Molgula lutulenta, *n. sp.*

(Plate VIII, figs. 7–10.)

Body of ovate form, measuring about 3 × 2 cm., thickly covered with a dense coating of fine mud attached to delicate hairlike processes of the test (fig. 7). The mud particles are very readily rubbed off leaving the hairs projecting as a fine down. Apertures on anterior end, inconspicuous, about 1 cm. apart.

Test thin and membranous.

Mantle closely attached to inner surface of test; muscular, with strong bands running radially from the base of the sphincters.

Branchial sac with nine folds on each side, four to six bars on a fold, stigmata in some parts coiled into infundibula, in other parts straight or slightly curved (fig. 9). Many of the interstigmatic vessels bear little papillæ, which may grow together to form short transverse bars on the inner surface of the branchial sac (fig. 9).

Dorsal lamina a plain lamina with a slightly crenate free edge (fig. 8).

Tentacles about eighteen, of different sizes, with other much smaller intermediate ones, the smallest of which are simple papillæ (fig. 10).

Dorsal tubercle very simple, shallow, crescentic, with the opening directed anteriorly and to one side. Sub-neural gland large, diffuse, lobulated (fig. 10, *s.n. gl.*)

Locality.—Station X, 29th January, 1914, 340 fathoms: two specimens; the smaller is about 1·5 cm. in length.

Molgula concomitans, *Herdman.*

One specimen was dredged at Station X, 29th January, 1914, 340 fathoms, which agrees well with the description of this species, obtained at McMurdo Bay by the "Discovery" expedition, in all respects except that the musculature of the mantle is not so strong, and that there are seven folds on each side of the branchial sac, and a few more longitudinal bars in the spaces between folds. The "Discovery" specimen had seven folds on the right side and only six on the left, but that need not be regarded as a serious difference; it may be only an individual variation. In regard to the musculature of the mantle, the difference may be due to the fact that

the "Discovery" specimen was preserved in strong spirit, which has a tendency to contract the mantle so as to emphasise the muscle bands, while the present specimen is preserved in formalin, which leaves the mantle softer and more flabby.

This species has a characteristic soft, grey-coloured, test, covered with fine hairs or little tags, with no muddy investment, and not pedunculated nor attached. It is certainly not the same as *M. maxima*, Sl., and *M. pedunculata*, Hrdm., as Sluiter supposes.

In the present specimen I find about six bars on a fold and six or seven bars in the interspace. The stigmata are mostly straight, but in places may be curved. The small blood-spaces in the horizontal membranes of the branchial sac along with internal longitudinal vessels are engorged with blood corpuscles, and stand out as a conspicuous net-work on the inner surface of the branchial sac. Traces of this engorged system of fine vessels on the inner surface of the branchial sac are shown in my figure of the branchial sac of the "Discovery" specimen (that Report, pl. V, fig. 5). The alimentary canal on the left side of the body extends from the posterior end along both dorsal and ventral edges nearly to the anterior end, and along with the large gonad in the intestinal loop occupies the greater part of the left side of the body. The right side has a large yellow, sausage-shaped, gonad; behind which is a large curved renal organ.

The dorsal tubercle is prominent, cordate, with the opening directed posteriorly and both horns turned inwards.

A second specimen obtained at Station I, Adelie Land, 354 fathoms, clearly belongs to the same species as the above.

Molgula euplicata, *n.sp.*

(Plate X, figs. 1–6.)

Body.—Shape ovate, 5 × 3·5 cm., not attached; apertures both anterior, sessile, about 1·5 cm. apart.

Test thin and semi-transparent, covered with fine hairs, with a little sand, shell fragments and polyzoa adhering, especially at posterior end.

Mantle thick, opaque, and muscular, especially round siphons.

Branchial sac with eight or nine folds on each side, the most ventral ones being very slight and reduced to one or two bars. The larger folds have six to nine bars, and there are one to three bars in each interspace. There are fairly frequent broad transverse vessels, and very numerous fine connecting vessels which cross the stigmata transversely and obliquely (fig. 4). Many of the blood vessels of the branchial sac are in places engorged with dark-coloured blood corpuscles, so as to form conspicuous networks (figs. 5 and 6). The stigmata are very irregular.

Dorsal lamina a short plain membrane.

Tentacles fourteen to sixteen, of two sizes, placed alternately. The larger ones are much branched.

Dorsal tubercle prominent, but simple, circular or cordate; opening directed postero-laterally, both horns turned inwards (fig. 3, *a;* fig. 3, *b* shows another specimen where the opening is directed laterally.

Viscera.—The alimentary canal and the left gonad occupy the posterior end and the postero-dorsal edge of the left side. The right side showed an elongated gonad and large curved renal organ (fig. 2).

Localities.—

1. Station I, 22nd December, 1913, 358 fathoms; one specimen.
2. Station X, off Wilkes Land, 340 fathoms; one specimen measuring about 3 × 2 cm.
3. Commonwealth Bay, Adelie Land, lat. 67° S., long. 142° 36′ E., 3rd and 4th September, 1912, 25 to 30 fathoms; one specimen, measuring 4 × 3 cm.
4. Locality doubtful—possibly Station X; one specimen, measuring. 2·5 × 2 cm.

I place all these specimens in the one species although they present slight differences from one another in the folds of the branchial sac, and the number of bars on a fold and in the interspace. The characteristic arrangement (as shown in fig. 4) is to have one bar near the base of each fold dividing the space into a narrow area close to the fold and a much wider space extending to the next fold. In the larger (older) specimen a few additional slighter bars make their appearance in the interspace.

This species and *Molgula lutulenta* (see above) have an unusually large number of folds. There seem to be no other Molgulids recorded with nine folds on each side with the exception of *Halomolgula* (= *Bathypera*) *ovoida*, Ritter. In regard to the external appearance of this species, as there are very long funnels of invaginated test at the apertures it is probable that when expanded in life the siphons may have been considerably elongated.

Family HALOCYNTHIIDÆ.

BOLTENIA ANTARCTICA, *v. Ben.* and *Sel. Long.*

(Plate X, figs. 7–9.)

Body measuring about 3 × 2.5 cm., stalk may be up to 30 cm. in length, and varies from 1 to 2 mm. in diameter. The stalk is attached to the middle of the ventral edge. The apertures are very distinctly four-lobed, placed far apart, the branchial near the stalk and the atrial at the opposite extremity of the body (fig. 8). The test is thin but tough, with a fine coating of minute hairs all over the surface.

The branchial sac has seven folds on each side. There are thirteen to fifteen bars on a fold, and two or three in the interspace. There may be as many as twelve to fourteen stigmata in a mesh, but other parts do not show so many. A narrow horizontal membrane crosses the mesh (fig. 7).

About eight large compound tentacles and some smaller intermediate ones making about fourteen in all.

Dorsal tubercle rather large, cordate, with the opening anterior, and both horns coiled inwards (fig. 9).

Localities.—(1) Station VIII, 27th January, 1914, 120 fathoms, five specimens; (2) Station X, 29th January, 1914, 340 fathoms, four specimens; (3) Station XII, 31st January, 1914, 116 fathoms, one specimen.

I have no doubt that this is the species described by E. van Beneden and M. de Selys-Longchamps from the "Belgica" collection under the name *Boltenia antarctica*. Their specimens, seven in number, were obtained at lat. 70° S., long. 80° 48′ W. from a depth of 580 metres. The external characters and most of the details of internal structure of our specimens in the "Mawson" collection agree closely with those from the "Belgica." There are, however, a few minor differences which I might refer to: *B. antarctica* is described as having about twelve tentacles which may be of somewhat different sizes. Our specimens show eight large tentacles and some smaller, about fourteen in all. In the branchial sac the "Belgica" specimens have fifteen to twenty bars on a fold and two or three in the interspace, while ours show thirteen to fifteen on a fold and two or three between folds. The number of stigmata in the larger meshes is greater (twelve to fourteen) in ours than in the "Belgica" specimens, but this is evidently a character which varies much, even in different parts of the same branchial sac.

I agree with the authors of the "Belgica" Report that their *Boltenia antarctica* is a distinct species from the *B. bouvetensis* of Michaelsen.

Microcosmus spinifer (*Herdman*).

Cynthia spinifera, Herdman, Cat. Austr. Mus. (1899), p. 32.

M. acanthifera, Hartmeyer, Bronn, p. 1341.

One specimen of this species, measuring 13 mm. in diameter, was found adhering to one of the specimens of *Rhabdocynthia draschii* from 65 fathoms off Maria Island, Tasmania. It agrees in all respects with my description of *Cynthia spinifera* in the Catalogue of Tunicata in the Australian Museum (1899).

I notice that Hartmeyer (Bronn, p. 1341) quite unnecessarily gives a new name ("*acanthifera*") to this species, presumably on the ground that the name "*spinifera*" was pre-occupied by the "Ascidia spinifera" of Quoy and Gaimard. But that species obtained during the voyage of the "Astrolabe," is really a *Boltenia*, and consequently the name *spinifera* is not pre-occupied in the genus *Cynthia* (*Halocynthia*), to which I referred the species. But even if *Boltenia* be included in Hartmeyer's *Pyura* (= *Halocynthia*) there is still another reason why his name "*acanthifera*" is unnecessary and non-valid, and that is that Hartmeyer himself (in "Bronn") recognises that my species really belongs to the genus *Microcosmus* (not *Pyura*), in which there is no other species *spinifera*, and therefore by the rules of nomenclature my original specific name holds good, and consequently the correct name of the species is *Microcosmus spinifer* (Herdman).

Rhabdocynthia draschii (*Herdman*).

(Plate XI, figs. 1–9).

Microcosmus draschii, Herdman, Cat. Tun. Austr. Mus., p. 20.

About twenty specimens of this large species of *Rhabdocynthia*—distinguished from *Halocynthia* by the presence of abundance of fusiform calcareous spicules in the body-wall—were dredged by Professor T. T. Flynn from 65 fathoms, 12th December, 1912, off Maria Island, Tasmania. They average about 6 × 4 cm., with dirty white or yellowish grey, soft leathery tests, and the two large square apertures on the wide anterior end (fig. 1.) When the apertures are closed they assume the cross-form shown in fig. 2. The dark-brown mantle is very muscular, and bristles with the abundant echinated spicules (see also Cat. Tunicata in Austr. Mus., 1899, Pl. Cyn. III) which are visible to the eye on opening the test (fig. 3). In most of the other internal characters—the numerous folds of the branchial sac (at least ten, and usually more), the large and small tentacles (eight to twelve of each), the very wide pre-branchial zone and the dorsal languets—these specimens from Tasmania agree with the description of the Australian Museum specimens from Port Jackson and Port Stephens. But there is one organ which shows a notable difference. The dorsal tubercle in the original description and figures is shown as a rounded elevation with an elaborate pattern all over its surface, while in the specimens now before me in the "Mawson" collection the tubercle, though large, is not prominent, and is of an ordinary type, consisting of two rather irregularly coiled

loose spirals (see figs. 7 and 8). I can only suggest that in some of the much larger Australian Museum specimens (up to 16 × 12 cm.) the tubercle had become much more complicated, so as to resemble that of *Microcosmus julinii*, v. Drasche.

In the original description, with considerable hesitation (p. 23), I placed this species in the genus *Microcosmus*, notwithstanding the presence of dorsal languets. I now think that was a wrong course to adopt, and that the species must be regarded as a *Rhabdocynthia* because of the dorsal languets (fig. 9), the spicules in the body-wall (figs. 3–5), and the fairly wide intestinal loop.

I notice that Hartmeyer, in "Bronn" (p. 1345) places this species as a synonym of *M.* (*Cynthia*) *claudicans* (Sav.), which it is certainly not. Savigny's *Cynthia claudicans* is a small European species, "très-commune sur les Huîtres qu'on apporte à Paris," and Savigny could scarcely have failed to notice the abundant and conspicuous spicules which can be both seen with the eye and felt with the fingers when the animal of *R. draschii* is cut open.

Halocynthia discoveryi, *Herdman*.

(Plate. XI, figs. 10–13.)

There are about a dozen large specimens of this characteristic Antarctic species in the Mawson collection, and three or four smaller ones adhering to these. Most of them (about nine) were obtained at Station I, 22nd December, 1913, 358 fathoms; and a few from Station VIII, 27th January, 1914, 120 fathoms; and also from Station III, 21st December, 1913, 157 fathoms; and one from Commonwealth Bay, Adelie Land, 3rd September, 1912, 25–30 fathoms.

This species was established in 1910 for a specimen obtained by the British National Antarctic Expedition in the ship "Discovery," at the Winter Quarters in McMurdo Bay. In addition to the characteristic external appearance (fig. 10), the furrowed and corrugated test prolonged into ridges and knobs, and the long divergent siphons giving a cleft appearance, perhaps the best distinguishing feature of this species is the spread-out, undulating or serpentine dorsal tubercle, one form of which I showed in the "Discovery" report, at pl. IV, fig. 12, and of which I give another form here (pl. XI, fig. 13).

The German South Polar Expedition in the "Gauss" obtained four small specimens off Kaiser Wilhelm II Land at 170–385 metres, and in describing these Hartmeyer figures a simpler form of dorsal tubercle which is probably, as he suggests, an earlier stage of what I have figured.

In 1914, Sluiter described as a new variety of this species, var. *septemplicata*, thirteen specimens from the second French Antarctic Expedition under Dr. Charcot, and which he found had seven folds on each side of the branchial sac in place of the six I had recorded in the original description. The four specimens of the German Expedition were smaller than the "Discovery" one, and Sluiter's largest was twice

that size; but the present Mawson specimens are larger still, and by far the largest that have yet been found. One measures 6 × 5 × 2 cm., and a well-shaped average one is 5 × 4 × 2 cm., the siphons being each about 2 cm. in length. In another example, where the total length was 5 cm., the branchial siphon measured 2·5 cm.

In some specimens the siphons are distinctly four-sided or quadrangular in section, the ridges running down from between the lobes of the apertures (pl. XI, fig. 10).

The branchial sac may have either six or seven folds on each side. It has always six very distinct folds and may have a seventh on the ventral edge, close to the endostyle, which, however, is very slightly developed and has only three or at most four bars, while the larger, more dorsally-placed folds have from six to nine bars. There are three or four bars in each interspace between folds. On the whole the folds tend to diminish in height from the dorsal to the ventral edge. The thick, corrugated, white, invaginated test which lines the long branchial and atrial siphons ends internally in each case in a well-marked diaphragm which greatly reduces the lumen of the tube.

The remarkable dorsal tubercle shows some variation. Sluiter finds in his specimens both the complicated serpentiform dorsal tubercle that I originally described, and also, in smaller examples, the simpler form figured by Hartmeyer. In the present collection every specimen shows it as a more or less spread out and undulating form (fig. 13), with central and lateral U-shaped loops open anteriorly; but some are less elongated, more condensed, simpler, and more tubercle-like than others. Still, it is a most characteristic feature and one of the surest guides to the identification of the species.

Gonads are well developed on both sides of the body, in the form of very many yellow masses, of rounded or quadrangular shape and hermaphrodite structure, united together by ducts into a single large gonad on each side.

I do not attach much importance to the difference in details of the branchial sac given by Sluiter for his variety. I find similar variations in different parts of one specimen. The compound sparsely branched tentacles (fig. 12), the languets of the dorsal lamina (fig. 11), and other details given in the descriptions of Hartmeyer and Sluiter agree well with my present specimens, and there can be no doubt we are all dealing with one and the same species.

Halocynthia cerebriformis (*Herdman*).

(Pl. X, figs. 10–11.)

Cynthia cerebriformis, Herdman, "Challenger" Report (1882), p. 136.

? Cynthia multiradicata, Herdman, Cat. Tun. Austral. Mus. (1899), p. 30.

Two specimens of this Australian species were collected by Professor Flynn, at 65 fathoms, off Maria Island, Tasmania, 12th December, 1912. One has a nearly

globular body measuring 4 × 3·5 cm. across, and borne on a stout stalk about 4 cm. long, spreading out into roots at the base. The other specimen is longer, more pear-shaped, measuring 5 × 3·5 cm., and has very little stalk, the half-dozen branching roots spreading direct from the narrower posterior end of the body. Both specimens are rather browner in colour than the "Challenger" specimen, from Port Jackson, 30–35 fathoms, from which the species was described. In that specimen also the corrugations on the surface of the test were pronounced, and more convoluted, which accounts for the specific name "cerebriformis," but these and a few other slight differences are probably individual variations only. The anterior end of the body, for example, is not so much bent over to the right side as in the "Challenger" specimen, but still both apertures are distinctly on the right-hand side of the anterior extremity. The apertures again are not so prominent, and both siphons are alike in size. The invaginated test lining the atrial siphon ends in a diaphragm with a series of crenations or lobed processes at its free margin.

The test and mantle agree exactly with the "Challenger" description. The branchial sac, with its six large folds on each side, also agrees well; but there are occasional transverse vessels much wider than the rest, and some of the meshes are elongated transversely and may contain as many as ten stigmata. So I would now define the meshes as having six to ten stigmata (fig. 10), and the stigmata are rather longer than those shown in the "Challenger" figure. The tentacles in one specimen are fourteen, of two sizes, large and small alternating, with additional still smaller intermediate ones between. The internal longitudinal bars number about ten on each side of a fold, and ten in the interspace between two folds.

A number of small specimens, 2–3 mm. long, probably young, of *Polycarpa* (? *P. pilella*) are attached to the anterior part of the test of the larger of our specimens.

This species certainly comes very near to *Cynthia multiradicata* Herdm., from Port Stephens, described in the "Catalogue of Tunicata in the Australian Museum" (1899), p. 30, and I am now inclined to think that it may possibly be the same species. The internal structural features (branchial sac, &c.) agree fairly well; and as to the external characters, the chief difference is in the position of the apertures in relation to the place of attachment, and this may have been affected in the Australian Museum specimen (*Cynthia multiradicata*) by its unusual position, as it is attached to another ascidian (*Styela whiteleggii*) by a large number of roots springing from the ventral edge not far from the branchial aperture. The corrugations on the surface of the test take the form of knobs rather than convolutions.

If this specimen is included, I have now examined four examples, all differing a little from one another, of what may be the one species, viz., the "Challenger" *C. cerebriformis* (Port Jackson), the Australian Museum *C. multiradicata* (Port

Stephen), and the two "Mawson" specimens from Tasmania; and of the latter two, now before me, one has a stalk like the "Challenger" form, and the other has abundant roots like the Australian Museum specimen, though not developed to such an extent. I believe, notwithstanding these differences in external appearance, the essential agreement in internal structural characters justifies me in regarding it as at least probable that all four belong to the one somewhat variable species, and in that case the diagnosis given in the "Challenger" report should be modified in the direction I have indicated above.

Halocynthia (Pyura) setosa, *Sluiter*.

1. Station I, 22nd December, 1913, 358 fathoms; four specimens measuring 9, 6, 5, and 4 cm. respectively in length.
2. Commonwealth Bay, Adelie Land, 14th December, 1913, 45–50 fathoms; two small specimens about 3 cm. in length.
3. Commonwealth Bay, 21st December, 1913; one small specimen.

This is a characteristically Antarctic species which has now been found at Ile Booth Wandel by the French Antarctic Expedition under Dr. Charcot, at the South Orkneys by the "Scotia" Expedition, at McMurdo Bay by the "Discovery," at Kaiser Wilhelm II Land by the "Gauss," and off Adelie Land by the "Mawson" Expedition.

I notice that Sluiter, in his report on the Tunicata of the second "Charcot" Expedition (p. 10), takes exception to my mild criticism of the figure of this species (his *Pyura setosa*) given in the Report on the First French Antarctic Expedition. I will merely remark now that his figure (pl. V, fig. 57) gives no indication whatever of the very pronounced and characteristic echinations which cover the long spines. Now these echinations, like little hooks and spinules, are plainly visible to the unaided eye (see my figures 1 and 2, pl. II, in the report on the "Discovery" Tunicata), while their exact appearance under a low power of the microscope is shown in figs. 2A, 2B, and 2C. I have now re-examined these spines, and maintain that my figures are correct, that the spines stand up or "bristle" from the test in all directions, and that their echinations are conspicuous, giving an appearance very different from the smooth, curved, soft-looking processes of Sluiter's original figure.

Halocynthia flynni, *n.sp.*

(Plate XII, figs. 9–12.)

Body ovate, rounded at posterior end, where attached, and rather broader and flatter in front (which may be in a contracted condition). Branchial aperture at dorsal edge of anterior end, atrial on dorsal edge a little way back, sessile; both four-lobed. Surface wrinkled, colour yellowish-brown. Size, 2 × 1·5 cm.

Test coriaceous, tough, but not thick. Branchial siphon lined by test with numerous little sharp-pointed processes arranged in many irregular rows (fig. 12).

Mantle fairly muscular (fig. 9).

Branchial sac, with six folds on each side, six to eight bars on a fold and two or three in the interspace; occasional wider transverse vessels, and narrow horizontal membranes crossing some of the meshes (fig. 11); four or five stigmata in a mesh. In the folds the stigmata have a twisted or undulating appearance (fig. 11), due perhaps to contraction.

Dorsal lamina with narrow-pointed languets (fig. 10).

Tentacles not large and rather sparsely branched, number uncertain.

Dorsal tubercle simple, between crescentic and cordate, opening antero-lateral.

Viscera.—Alimentary canal forming a narrow loop at posterior end of left side (fig. 9). Gonads on both sides, elongated and curved.

Locality.—Off Maria Island, Tasmania, 12th December, 1912, 65 fathoms; one specimen—which I have named in honour of Professor T. T. Flynn, who contributed this and several other interesting species to the collection.

STYELA LACTEA, *Herdman.*

? Cynthia verrucosa, Lesson, Cent. Zool. (1830), p. 151.

Tethyum verrucosum, Michaelsen, Hartmeyer, and others.

1. Commonwealth Bay, Adelie Land, 14th December, 1913, 45–50 fathoms; one specimen about 3 cm. in length.
2. Same locality, 3rd September, 1912, 25 fathoms; two specimens about 15 mm. in diameter.
3. Station I, 22nd December, 1913, 358 fathoms; one specimen 4 cm. in length and one (very large for this species) measuring 13 × 9 cm.
4. Station VII, 21st January, 1914, 60 fathoms; two specimens measuring respectively 6 and 7 cm. in length.
5. Station III, 21st December, 1913, 157 fathoms; one specimen 4 cm. in length.

This is a common southern form which has been recorded from Kerguelen Island by the "Challenger" Expedition, from South Georgia by Michaelsen, from Ile Booth Wandel by the "Charcot" Expedition, from the Falklands and the South Orkneys by the "Scotia," from Cape Adare by the "Southern Cross," and from Kerguelen and Kaiser Wilhelm II Land by the German "Valdivia" and "Gauss" Expeditions, in addition to those in the present collection.

Hartmeyer, in his report on the Ascidians of the "Valdivia" Expedition, p. 250 (1912), argues that the "Challenger" species *S. lactea*, from Kerguelen, with its soft white test and barrel-like shape, is distinct from *S.* (*Cynthia*) *verrucosa*, Lesson, of more globular form and covered with spine-bearing papillæ; and he considers that the small globular forms which in my report on the "Scotia" material I referred to *S. lactea* ought

really to be called *S. verrucosa*. I have already myself commented ("Scotia" report, 1912) on the close relationship, if not identity, of these forms, and of Sluiter's *S. flexibilis*, and it may be, as several writers have suggested since, that with age and growth the characteristic papillæ tend to disappear,* and that the "verrucosa" form is really the young of the adult "lactea" form represented in the "Challenger" report at pl. XIX, fig. 7 (see also Sluiter in his report upon the second "Charcot" Expedition, p. 16, although I do not agree that *Styela spectabilis* is also only a gigantic specimen of *S. verrucosa*). Finally, I would point out again that Lesson's figure of his *Cynthia verrucosa* shows five lobes around each aperture, while all specimens, both large and small, that I have referred to *S. lactea* have both apertures most distinctly four-lobed.

Styela subpinguis, *n.sp.*

(Plate XII, figs. 1–5.)

? Styela pinguis, Herdman, Cat. Tun. Austral. Mus. (1899), p. 37.

Body oblong-ovate, attached at posterior end; branchial aperture anterior, but not quite terminal; atrial on dorsal edge of anterior end about 1·5 cm. from branchial; both four-lobed, sessile; surface smooth, colour white; length 5 cm., breadth 2 cm.

Test white, opaque, soft, thickened at posterior end.

Mantle thin, muscle bundles fine, forming a delicate network.

Branchial sac with four well-marked folds on each side; 10–12 bars on a fold, and at least the same number in interspace, bars wide, ribbon-like; meshes large, with about ten very long stigmata, crossed by a narrow horizontal membrane (figs. 2 and 3).

Dorsal lamina a plain smooth membrane.

Tentacles sixteen in number, of two sizes.

Dorsal tubercle irregularly cordate, aperture anterior, one horn turned in and the other slightly out (fig. 5).

Alimentary canal long, occupying dorsal edge of left side; œsophagus narrow, stomach ovate, with longitudinal ribs, intestine very long and rather convoluted, anus lobed (fig. 4).

Gonads, one on each side, forked, the dorsal branch being the longer (fig. 4). Endocarps abundant.

Localities.—

1. Station I, 22nd December, 1913, 358 fathoms; one specimen.
2. Station X, 29th January, 1914, 340 fathoms; one specimen.

* But against that I can state that in the present collection even the largest specimens, up to 13 cm. in length, have well-marked papillæ and spines, although these are not so regularly and closely placed as in the small globular specimens (see my figures in the Report of the "Scotia" Expedition, Trans. R.S. Edin., xlviii, p. 311, figs. 1–6, 1912).

These specimens show a close resemblance externally, and in some respects internally, to *Styela pinguis*, Herdm., from Port Jackson, but differ so markedly in the alimentary canal and gonads that I think it best to describe this form as a new species. It will be noticed incidentally that it is from much deeper water, as well as far further south. In regard to the external appearance, the larger specimen (pl. XII, fig. 1) is of that slightly hyaline milk-white tint which, as the result of experience, I suspect to be of a red colour when living. The smaller specimen has still a slight pinkish tint in places.

The presence of occasional very long stigmata in the branchial sac, extending across even one of the wider transverse vessels (see fig. 3), is very unusual in the genus. The characters of the alimentary and reproductive viscera can be seen from fig. 4. The folds on the stomach-wall are about ten on each side, and there are about ten prominent lobes on the margin of the anus. Numerous small endocarps are scattered all over the inner surface of the mantle.

The atrial aperture is more nearly anterior than in the Port Jackson specimens of *S. pinguis* which I have examined, but it is possible that this may be the same species. I cannot find any very convincing points of agreement, nor yet any very important points of difference except the condition of the gonads, which may, however, be in a different reproductive phase.

Finally, in some respects (test, branchial sac, and alimentary canal) our specimens show some resemblance to *S. serpentina*, Sluiter, from the second " Charcot " Expedition. If all three species ever come to be united, the name which has priority is *Styela pinguis*, Herdman.

Styela personata, *Herdman*.

Three specimens of this Port Jackson species (see Cat. Tun. Austral. Mus., p. 41) were dredged off Maria Island, Tasmania, from 65 fathoms. The largest measures 5 × 4 cm., and the two smaller about 4 × 3 cm. One of the latter is remarkable as having two atrial apertures, both opening into the one cloaca—a condition which has been described as an occasional abnormality in a few other Ascidians, and is probably the persistence of an early post-larval character. The two smaller specimens are narrower than is typical for the species, but in other respects agree with the larger individual. The tentacles seem to vary from twenty to thirty, with some smaller intermediate ones.

The dorsal tubercle is also variable, from broadly cordate to U-shaped, with both horns turned in, or one in and the other out.

Styela insinuosa, *Sluiter*.

(Plate XII, figs. 6–7.)

This species was obtained at two localities :—

1. Station X, 29th January, 1914, 340 fathoms; one specimen measuring 4 × 1·4 cm., of a pinkish-gray colour.

2. Commonwealth Bay, Adelie Land, 3rd September, 1912, 25 fathoms; four specimens ranging from 2·5 to 1·5 cm. in length, and all of a pale yellowish-gray colour.

Notwithstanding the slight difference in colour, these five specimens all clearly belong to this well-marked species. The branchial sac (fig. 7) is especially characteristic, and I agree with Sluiter that the four broad ribbon-like bars and the crowded stigmata behind them represent greatly reduced folds. In the spaces between these bars I find an average of about thirty stigmata, but some have more. The transverse vessels are distinctly of three sizes, and I find the longitudinal bars generally even wider than is shown by Sluiter (see fig. 7). In all other respects my specimens agree perfectly with the description and figures given by Sluiter in his report on the Tunicata of the second French Antarctic Expedition, p. 24. Even the external appearance of this little species—the erect, cylindrical form with two prominent apertures at the anterior end (fig. 6) and the surface of the test cut up into regular little scale-like areas—is most characteristic and easily recognisable.

Polycarpa rigida, *Herdman.*

(Pl. XII, fig. 8.)

? P. longisiphonica, Hrdn., "Challenger" Report, Tunicata (1882), p. 177.

? P. jacksoniana, Hrdn., Cat. Tun. Austr. Mus. (1899), p. 50.

There are about thirty specimens in the present collection which were dredged by Professor T. T. Flynn from 65 fathoms off Maria Island, Tasmania, and which in some respects agree with *P. rigida* as described in the "Challenger" report, and in other respects resemble *P. jacksoniana* of the Australian Museum Catalogue. *P. longisiphonica* is no doubt a closely-related form. All three species, if distinct, belong to the same section of *Polycarpa*, and all have been recorded from Bass Strait, and from Port Jackson or Port Stephens, or both. It is much to be desired that some Australian Zoologist should study these forms in the living condition, and determine whether the slight differences that have been described from preserved specimens can be maintained as constant or are bridged over by intermediate conditions.

The present specimens from near Tasmania all show the charactistic rigid, brittle, sandy condition of the test, and all show more or less of the curvature of the body with the convexity ventral which is figured in both species (*P. rigida* and *P. jacksoniana*) in my Australian Museum Catalogue. A few notes may be added from the specimens before me for comparison with the published descriptions.

The branchial sac has 10–11 bars on a fold, and may have as many in the interspace. The transverse vessels may be very wide and are of at least three orders, with, usually, seven narrower between a pair of the widest, so as to give the formula 1, 3, 3, 3, 2, 3, 3, 3, 1—where 1 represents the widest order and 3 the narrowest. The

meshes are usually a little elongated transversely, and contain about five short, wide stigmata each. The stigmata are in some places reduced to minute round openings, irregularly arranged. There are in some places wide horizontal membranes, like shelves, projecting from the transverse vessels. The numerous small hermaphrodite polycarps are deeply imbedded in the thickness of the mantle, as was noted in the "Challenger" report (p. 176).

There remain the tentacles and the dorsal tubercle (see fig. 8), and these are the organs which seem most unlike in the original descriptions of the three species *rigida*, *longisiphonica*, and *jacksoniana*, but with the more abundant material which I have now before me these differences tend to disappear, the gaps being bridged over by intermediate forms. The dorsal tubercle is always simple and U-shaped, but the horns may turn inwards or outwards or one in each direction. I find all the shapes which I had previously figured and others, but still there is a general resemblance between them all. The tentacles also, though differing in detail in individuals, show a common character which is recognisable. To the eye, they are short, stumpy, and rather distant; but when a portion of the circlet is examined with the microscope it is found that only the larger tentacles had been seen, and that there are much smaller ones between, which, however, vary greatly in number and in size—thus accounting for the differences in the original descriptions of the species. The larger tentacles show the ridges of thickened epithelium producing the appearance of double parallel lines (fig. 8), which I figured in the "Challenger" report in the case of *Polycarpa longisiphonica*. One of the difficulties of identifying Ascidians in preserved collections from the Antarctic or other remote seas lies in the fact that in many cases only a single specimen exists—or very few—and in the absence of any knowledge as to the range of individual variation in the species the only course is to describe the individual.

With the considerable series from Tasmania in the collection before me, I am sure that they all belong to the species which I described in 1899 as *P. jacksoniana*, but I also think it most probable that the Australian Museum forms to which I gave that name ought to have been referred to the species which I had previously described from the "Challenger" collection as *P. rigida*, and very possibly, in the light of the variations I have now found, *P. longisiphonica* may also belong to the same species. I am sorry that the appropriate name *jacksoniana* must lapse, but *rigida* has priority.

Family ASCIDIIDÆ.

Ascidia challengeri, *Herdman.*

(Plate XIII, figs. 1–4.)

The collection contains about three dozen specimens from several localities and various depths, which after full consideration I have decided to refer to this species, although some of them show variations which I shall describe below. There are a couple of dozen specimens from Station XII, 110 fathoms; five specimens from Commonwealth Bay, 55–60 fathoms; four specimens from Station I, 358 fathoms; and two specimens from Station VII, 60 fathoms; also three specimens collected by Professor T. T. Flynn off Maria Island, Tasmania, 12th December, 1912, 65 fathoms, the largest nearly 20 cm.

These specimens vary in size from 5 to 20 cm. in length. The atrial aperture is in most cases about one-quarter of the way from the anterior to the posterior end, but may be as far as halfway down the body. The test varies considerably in thickness, toughness, and opacity. The shallower-water specimens from Commonwealth Bay have the more rounded contour, softer test, and less prominent apertures characteristic of the "Challenger" species *A. meridionalis*, while those from the deeper water of Station I have the thicker and stiffer test and general appearance of *A. challengeri*. The shape is generally, especially in the larger specimens, rather wider and with less of a basal prolongation than that figured for the latter species in the "Challenger" report (pl. XXX). A specimen 15 cm. in length is from 6 to 7 cm. in breadth.

The internal organs agree in general with the description of the "Challenger" species, which was found in shallow water round Kerguelen Island. The branchial sac shows in some parts eight to ten stigmata in a mesh, and in other parts fourteen to eighteen stigmata. Intermediate papillæ are present on the internal longitudinal bars (fig. 4) in some branchial sacs and not in others. The dorsal tubercle shows the general characters described in the "Challenger" report, but has both horns turned inwards (see fig. 3).

The tentacles are longer and more slender than those of the Kerguelen specimens, and are not all of the same length, but are in general larger and smaller placed alternately (fig. 3). In this respect they show an approach to those of *A. meridionalis* from the Straits of Magellan and off the south-east coast of South America. In fact, the present deep-water Antarctic specimens which I refer to *Ascidia challengeri* to some extent bridge the gap between that species and *A. meridionalis*.

Of the four specimens from Station I, one had no dorsal tubercle, two were in imperfect condition at the anterior end, and the fourth has a large dorsal tubercle of the type of *A. challengeri*, but with both horns turned outwards, one to the right and the other to the left (see fig. 2).

It is possible that, when larger series of specimens from many localities in southern seas have been examined, it may be found that *A. meridionalis* can be united by intermediate forms with *A. challengeri*.

Three specimens of moderate size (5 to 8 cm. in length and 3·5 cm. in breadth) from Station X, 29th January, 1914, 340 fathoms, with a soft, smooth test slightly prolonged and thickened at the posterior end, may be younger deep-water forms of *A. challengeri*. They show a close resemblance to the figure (his pl. XLII, fig. 13) given by Hartmeyer of the young of that species. The branchial sac has rather shorter papillæ than the typical *A. challengeri*, the tentacles are from fourteen to eighteen, large and small alternately, and the dorsal tubercle is U-shaped, with both horns turned inwards.

Finally, it seems possible that *A. charcoti* Sluiter, obtained at several localities in Antarctic seas by both the "Charcot" Expeditions, may belong to this common and widely distributed southern species. It is described and figured by Sluiter as of a red colour in life, but many red Ascidians are found to be afterwards of a grayish colour when preserved in alcohol.

Ascidia placenta, *Herdman*.

(Plate XIII, figs. 5–6.)

? Ascidia meridionalis, Herdman.

Five specimens of *Ascidia* from Station II, 318 fathoms, ranging from 6 to 10 cm. in length, agree fairly well in character with the "Challenger" species *A. placenta*, which was obtained to the south of Kerguelen Island at 150 fathoms. The only doubt that remains as to giving this name to these specimens is whether *A. placenta* may not be a younger and softer or more flaccid form of *A. meridionalis*, obtained by the "Challenger" in the Straits of Magellan and elsewhere off the southern end of South America. These specimens from Station II had not had their tests slit open, and the result is that the internal tissues are more or less broken down and in a poor state of preservation. I can, however, give the following notes from my examination of them. The external appearance and the soft, crinkled condition of the test closely resemble the figures of the "Challenger" report. The unplicated branchial sac is shown in fig. 5, and the dorsal tubercle in fig. 6. The tentacles are long and slender and number about sixty, with a few additional much smaller ones. They agree in number with the "Challenger" *A. meridionalis* rather than with *A. placenta*. In some places the larger tentacles are distinctly of two sizes placed alternately. Two smaller specimens (3 to 5 cm.) from Station VII, 21st January, 1914, 60 fathoms, and not in sufficiently good condition for detailed examination, probably belong to this species, or may be young specimens of *A. challengeri*.

CORELLA DOHRNI, *van Beneden and Selys-Longchamps.*

Plate XIII, figs. 7–8.

? Corella eumyota, Traustedt, Vid. Medd. (1881), p. 271.

? Corella antarctica, Sluiter (1905).

Four specimens, which agree best with the description of *C. dohrni* given by M. de Selys-Longchamps in the Report on the Tunicata of the "Belgica" Expedition, were obtained by the "Mawson" Expedition at Station II, 31st January, 1914, from 358 fathoms.

They are of roughly quadrangular shape (pl. XIII, fig. 7), from 3 to 5 cm. in length, and from 2 to 3 cm. in breadth. The test is thick, measuring up to nearly 1 cm. where thickest, and is stiff, but transparent. The body when removed from the test is relatively small, and the viscera at the posterior end are very small. The muscles of the mantle are much stronger on the left side, especially along its dorsal and ventral edges. There are numerous long slender tentacles—about 70, of two sizes, with additional much smaller ones between (fig. 8). A large fat Amphipod occupied the greater part of the branchial sac in one, and could certainly not have got in or out through the branchial aperture in its present condition. The "Belgica" specimen was obtained at lat. 70° S., long. 80° 48′ W., 580 m., a locality in the neighbourhood of Graham's Land.

The question remains whether *Corella dohrni* is a distinct species or may belong to the widely distributed *C. eumyota* (= *C. antarctica*, Sluiter) which has been already recorded from Antarctic seas by Herdman (at the Aucklands, in "Discovery" report) and by Sluiter (at Ile Booth Wandel, 30 to 40 metres, in the first "Charcot" report). The "Mawson" specimens agree in all essential details with the "Belgica" description of *C. dohrni*, but are also in fair agreement with Sluiter's description of *C. antarctica*. If the latter is *not* the same as *C. eumyota*, then I think it probable that *dohrni* is the same as *antarctica*, and that Sluiter's name will have to be applied to the present species.

Family CLAVELINIDÆ.

? Stereoclavella sp. (?), &c.

In a small bottle labelled "Dredgings from Commonwealth Bay, 21st December, 1913," I find a very small (young) specimen of *Ascopera mawsoni*, one Molgulid test with no body inside, one small (young) *Halocynthia setosa*, and one young *H. discoveryi*, two small specimens of *Styela* sp. (probably young of *S. insinuosa*), and a little colony or group of ascidiozooids of a (?) Clavelinid, which may be a *Stereoclavella*, but is too imperfect to identify or describe with certainty. It may, on the other hand, be a compound Ascidian like Hartmeyer's "Synoicide incerti generis" of the "Gauss" Expedition, shown on his pl. LII, fig. 9.

EXPLANATION OF THE PLATES.

"Enlarged" means with the eye or a hand lens; "magnified" means with a low power of the microscope, magnifying 40 to 50 diameters.

Plate VIII.

Ascopera mawsoni, n.sp. (figs. 1–6).

Molgula lutulenta, n.sp. (figs. 7–10).

Fig. 1. Outline of one of the smaller adult specimens of *Ascopera mawsoni*, quarter natural size.

2. Young specimen of same, natural size.

3. Part of outer surface of test, showing tags, enlarged.

4. Portion of branchial sac from inside, natural size.

5. Part of branchial sac from inside, magnified.

6. Dorsal tubercle and tentacles, slightly enlarged.

7. *Molgula lutulenta*, natural size.

8. Part of dorsal lamina, magnified.

9. Part of branchial sac, from inside, magnified.

10. Tentacles (tn.), dorsal tubercle (d.t.), nerve ganglion (n.g.), subneural gland (s.n.gl.), dorsal lamina (d.l.), and neighbouring parts, magnified.

Plate IX.

Bathypera splendens, Mich.

Fig. 1. One of the specimens, from the left side, natural size.

2. Another more regular specimen, from the left side, natural size.

3. Branchial aperture (× 2).

4. Atrial aperture, enlarged.

5. The largest specimen with test removed, left side.

6. Arrangement of papillæ with calcareous spicules on the surface of the test, magnified.

7. Arrangement of papillæ on the invaginated test lining the branchial siphon; magnified.

8. Papillæ on surface of test seen in profile, magnified.

9. Isolated papillæ from the test, showing clumps of calcareous spicules; (*a*) young stage still enclosed in epithelial covering, (*b*) group of three spicules inside the epithelial covering through which the clump of spicules breaks when older and larger, magnified.

10. Group of more regularly rounded papillæ from the lining of the branchial siphon, magnified.

11. One of the most regular of the papillæ from the branchial siphon, more highly magnified.

12. Part of the wall of the branchial sac from the inside, showing two folds and the interspace between, natural size.

13. Small portion of branchial sac from inside, magnified.

14. Another part of branchial sac, magnified.

15. Part of dorsal lamina showing forked languets, enlarged.

16. Portion of an endocarp from the inner surface of mantle, magnified.

17. Part of the mantle showing muscle bundles, and system of blood-channels with masses of corpuscles in dilated ends, magnified.

Plate X.

Molgula euplicata, n.sp. (figs. 1–6).

Boltenia antarctica, v. Ben. and Sel. Longch. (figs. 7–9).

Halocynthia cerebriformis, Herdman (figs. 10–11).

Fig. 1. *Molgula euplicata*, left side, natural size.

2. Another specimen, with test removed, right side, natural size.

3. (*a*) and (*b*), two variations found in the dorsal tubercle, enlarged.

4. Part of branchial sac, showing a fold and part of an interspace, magnified.

5. Part of a branchial sac showing engorgement of the small interstigmatic vessels with deeply pigmented corpuscles, magnified.

6. Part of a branchial sac showing similar engorgement of two bars of a fold and neighbouring small vessels, magnified.

7. Part of branchial sac of *Boltenia antarctica*, magnified.

8. Outline of *Boltenia antarctica*, natural size.

9. Dorsal edge of branchial sac and dorsal tubercle, enlarged.

10. Part of branchial sac of *Halocynthia cerebriformis*, magnified.

11. Tentacle, dorsal tubercle and neighbouring parts of same, magnified.

Plate XI.

Rhabdocynthia draschii, Herdman (figs. 1–9).
Halocynthia discoveryi, Herdman (figs. 10–13).

Fig. 1. *Rhabdocynthia draschii*, removed from its test, natural size.

2. One of the apertures in the closed condition, natural size.

3. Mantle, showing muscle bundles and spicules (× 5).

4. Group of calcareous spicules from the mantle, magnified.

5. Part of one of the spicules, highly magnified, to show sheath and rows of very fine echinations (× 300).

6. Part of the branchial sac, from inside, magnified.

7. Dorsal tubercle of one specimen, enlarged.

8. Another dorsal tubercle, showing a variation, enlarged.

9. Three languets from the dorsal lamina, enlarged.

10. *Halocynthia discoveryi*, natural size.

11. Part of the branchial sac and dorsal languets, magnified.

12. Group of tentacles, magnified.

13. Dorsal tubercle, magnified.

Plate XII.

Styela subpinguis, n.sp. (figs. 1–5).
Styela insinuosa, Sluiter (figs. 6–7).
Polycarpa rigida, Herdman (fig. 8).
Halocynthia flynni, n.sp. (figs. 9–12).

Fig. 1. *Styela subpinguis*, n.sp., right side, natural size.

2. Part of branchial sac, from inside, showing a fold and part of an interspace, magnified.

3. Another part, showing the wider meshes between folds, magnified.

4. Alimentary canal and gonads, enlarged. R and L indicate the right and left sides respectively.

5. Dorsal tubercle, magnified.

6. *Styela insinuosa*, Sluiter, natural size.

7. Part of branchial sac, magnified.

8. *Polycarpa rigida*, Herdman, tentacles and dorsal tubercle, magnified.
9. *Halocynthia flynni*, n.sp., with test removed, left side, natural size.
10. Dorsal languets, magnified.
11. Part of branchial sac, showing fold and interspace, magnified.
12. Rows of minute tags on test lining branchial siphon, magnified.

Plate XIII.

Ascidia challengeri, Herdman (figs. 1–4).
Ascidia placenta, Herdman (figs. 5–6).
Corella dohrni, van Ben. and Sel. Longch. (figs. 7–8).

Fig. 1. *Ascidia challengeri*, Herdman, interior of branchial siphon and base of a large tentacle, magnified.
2. Dorsal tubercle of same, magnified.
3. Dorsal tubercle, &c., of another specimen, magnified.
4. Part of branchial sac, magnified.
5. Part of branchial sac of *Ascidia placenta*, Herdman, magnified.
6. Dorsal tubercle and tentacles of same, magnified.
7. *Corella dohrni*, van Beneden and Selys-Longchamps, left side, natural size.
8. Tentacles of same, showing the three sizes, magnified.

INDEX.

	Page.
antarctica (Boltenia)	17
Ascidiidæ	28
Ascidia	28, 29
Ascopera	9
Bathypera	11
cerebriformis (Halocynthia)	20
challengeri (Ascidia)	28
Clavellinidæ	30
concomitans (Molgula)	14
discoveryi (Halocynthia)	19
dorhrni (Corella)	30
draschii (Rhabdocynthia)	18
euplicata (Molgula)	15
flynni (Halocynthia)	22
Halocynthiidæ	17
Halocynthia	19, 20, 22
insinuosa (Styela)	25
lactea (Styela)	23
lutulenta (Molgula)	14
mawsoni (Ascopera)	9
Microcosmus	18
Molgula	14, 15
Molgulidæ	9
personata (Styela)	25
placenta (Ascidia)	29
Polycarpa	26
Rhabdocynthia	18
rigida (Polycarpa)	26
setosa (Halocynthia)	22
spinifer (Microcosmus)	18
splendens (Bathypera)	11
Stereoclavella	30
Styela	24, 25, 26
subpinguis (Styela)	24

[6 plates.]

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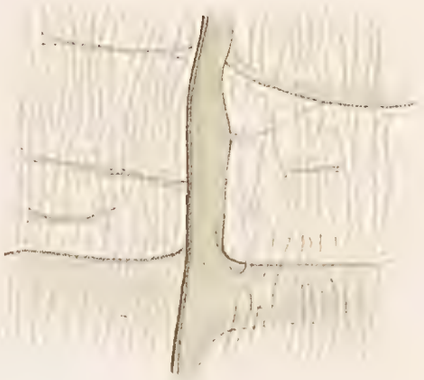
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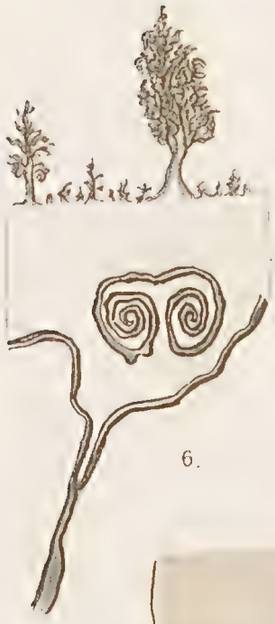
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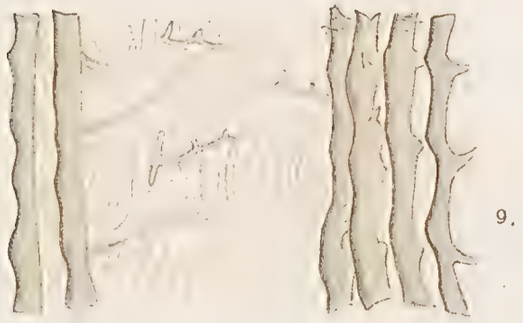
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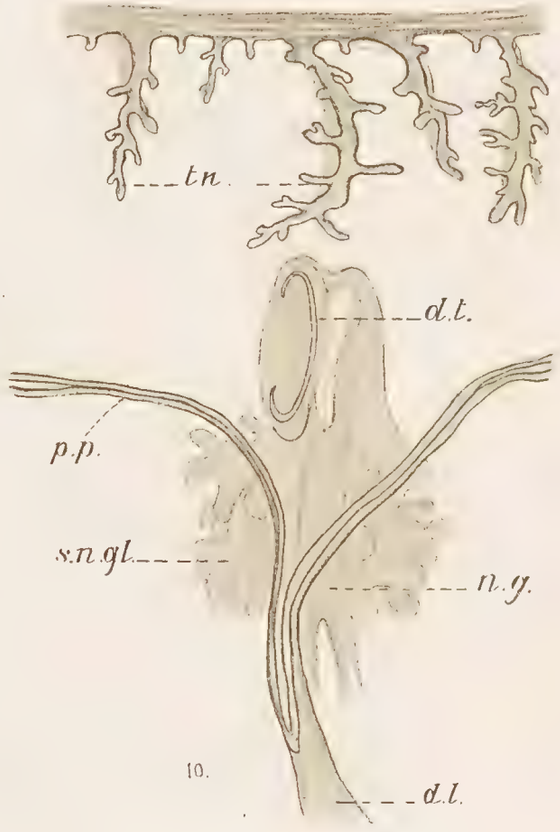

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Figs. 1-6 Ascopera mawsoni, n.sp.
Figs. 7-10 Molgula lutulenta, n.sp.

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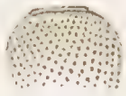
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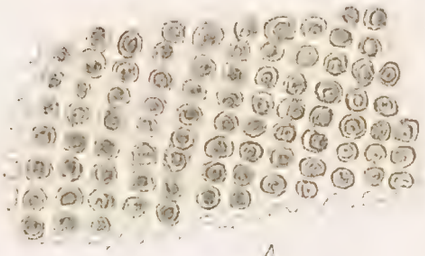
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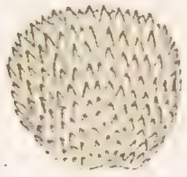
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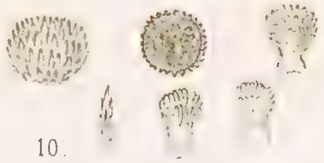
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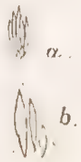
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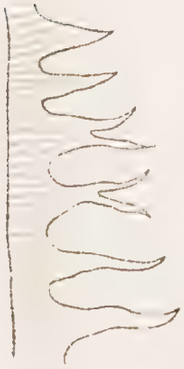
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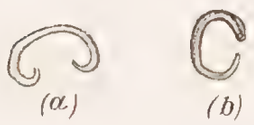

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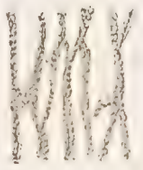

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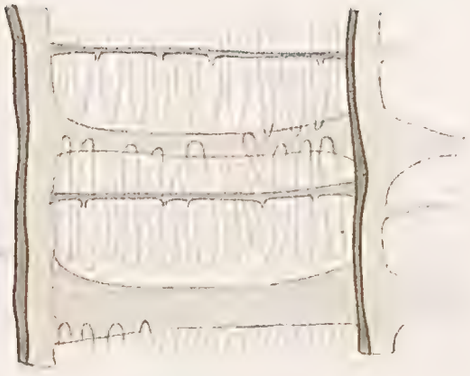

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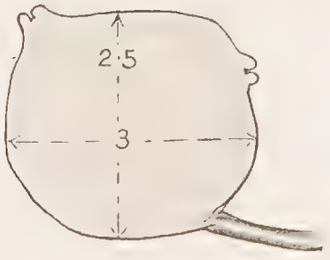

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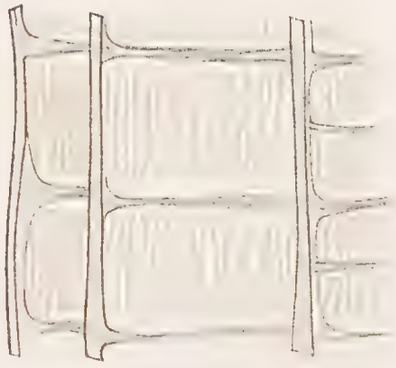

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Figs. 1-6 Molgula euplicata, n. sp.
Figs. 7-9 Boltenia antarctica.
Figs. 10-11 Halocynthia cerebriformis.

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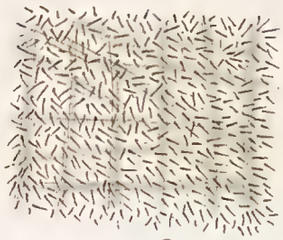
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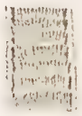
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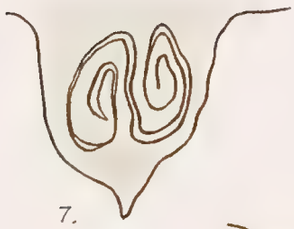
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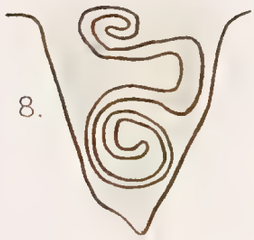
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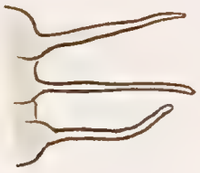
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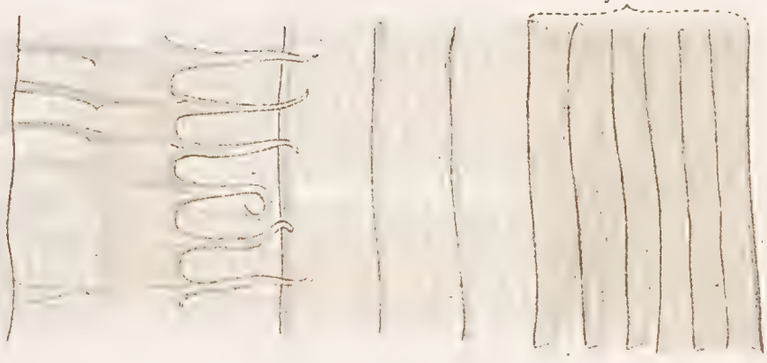

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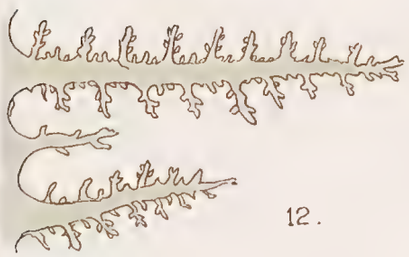
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Figs.1-9 Rhabdocynthia draschii.
Figs.10-13 Halocynthia discoveryi.

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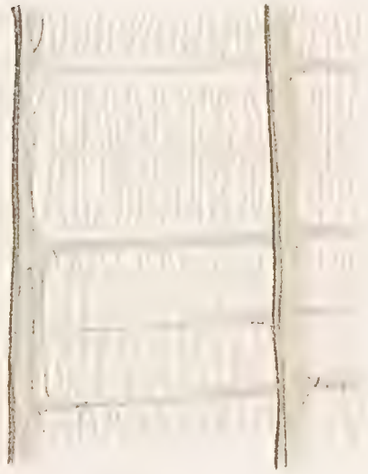
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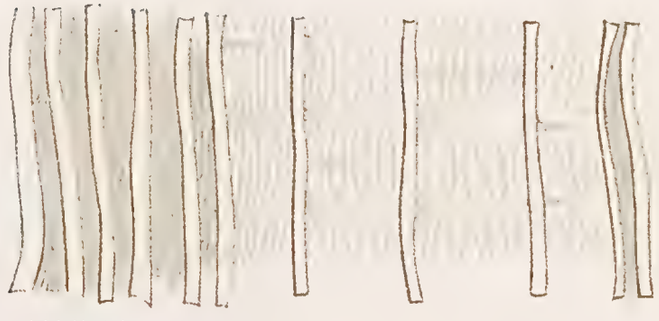
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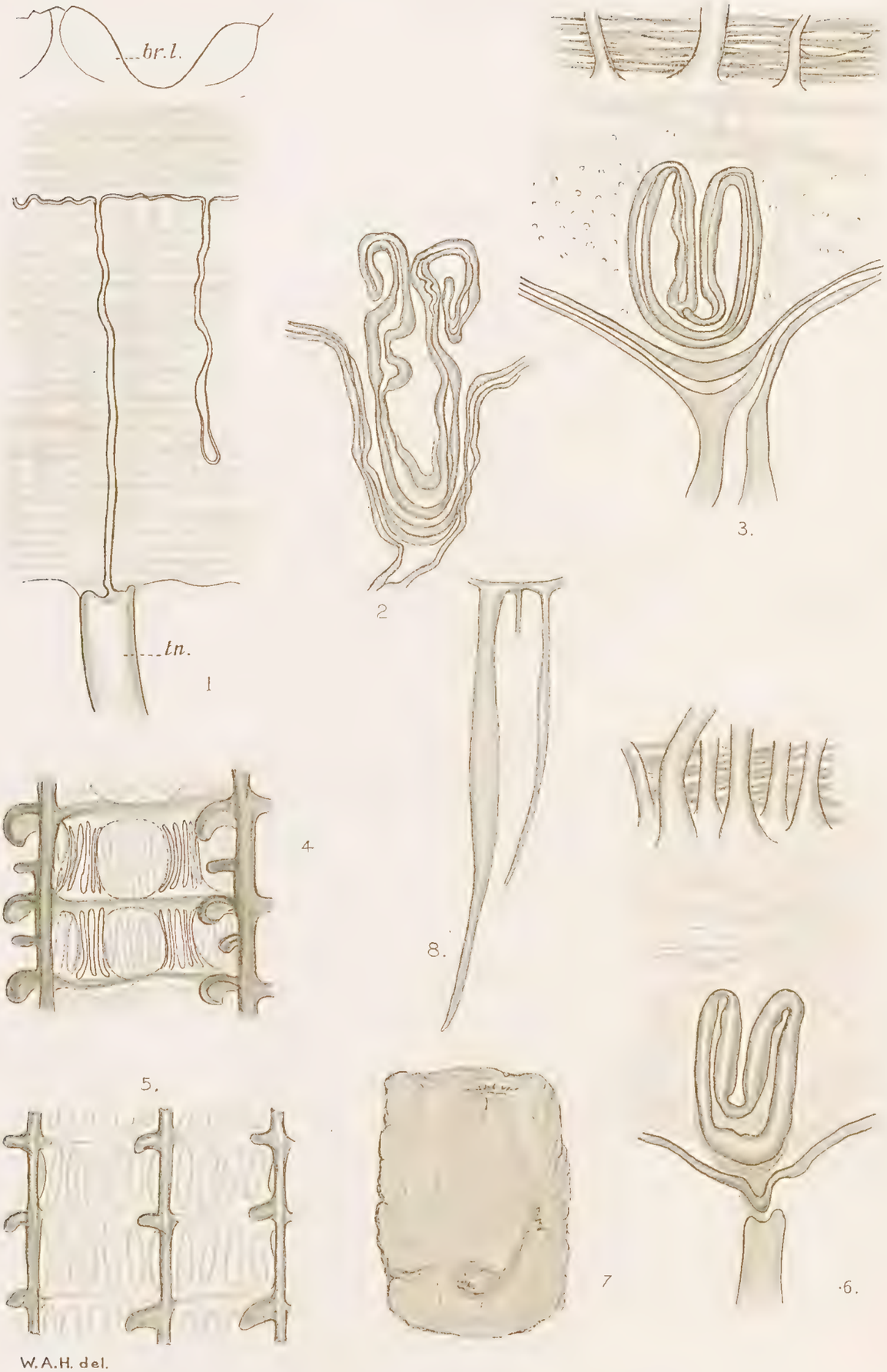
Figs. 1-5 Styela subpinguis, n. sp.
Figs. 6-7 Styela insinuosa.
Fig. 8 Polycarpa rigida.
Figs. 9-12 Halocynthia flynni, n. sp.



Figs. 1-4 Ascidia challengeri.
Figs. 5-6 Ascidia placenta.
Figs. 7-8 Corella dohrni.

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By T. Harvey Johnston, Professor of Zoology, University of Adelaide.

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The debris from the dredgings of the Australasian Antarctic Expedition, 1911–1914, remaining after various organisms had been sorted out from them and distributed to specialists for report, was forwarded to me by the Trustees of the Australian Museum, Sydney, for further examination. In one of the collections (G.12424, Australian Museum), that obtained from a dredging on 12th December, 1912, during the second subantarctic cruise of the " Aurora," in 65 fathoms off Maria Island, Tasmania, a few minute fragments of a species of *Rhabdopleura* were found. The sea floor was reported to consist of mud and foraminiferal sand. In view of the special interest associated with the Pterobranchiates, an attempt was made to identify the specimens. They were not detected in any of the material remaining from the dredgings from the Antarctic coast between Commonwealth Bay (King George V Land) and Queen Mary Land—stations 1 to 12 of the Australasian Antarctic Expedition.

There are two records of *Rhabdopleura* from the Australasian seas, viz., *Rhabdopleura* sp. by Harmer (1904, 23) who referred to finding a fragment from South Australia; and *R. annulata* Norman (1912, 98), collected by the British Antarctic (" Terra Nova ") Expedition from two localities (stations 90 and 91) close to the Three Kings Islands, to the north of New Zealand, in 183 and 549 metres respectively, on a rocky bottom. Norman's material was found on two small stones and on a larger stone, as well as on a lamellibranch shell, but was poorly preserved, the zooids being decomposed. Consequently only the coenoecium was described, but the account and figures are such that the species can be readily recognised.

The characters exhibited by the Tasmanian material are those of *R. annulata* whose known range is now extended from approximately 170° E., 34° S. (Three Kings) to 148° E., 42° 40 S. Harmer's Australian locality is indefinite. The late Sir Joseph Verco dredged extensively in the southern portion of St. Vincent's Gulf and the adjacent Investigator Strait and Backstairs Passage, and forwarded to Polyzoa to Harmer for identification. Rhabdopleura has been recorded as growing on polyzoa as well as on shells, corals and stones. I am not aware of any dredging in the deeper waters of South Australia prior to 1904, excepting that undertaken by Verco. Hence it is probable that Harmer's material came from the continental shelf in the vicinity of Kangaroo Island.

Verco also dredged off Bunbury, South-west Australia. If this supposition be correct then the species would probably be *R. annulata* and its known range would be extended considerably to the westward. Norman (1921, 101) believed that Harmer's (1905, 127, text-fig. 2) *Rhabdopleura* sp., taken by the Siboga Expedition at Station 204 in 75 to 94 metres between the islands of Wowoni and Buton off the south-east point of Celebes, belonged also to *R. annulata*. The species has been recognised by me from coenoecia dredged at two stations, No. 113 and 115, by the British, Australian and New Zealand Antarctic Research Expedition in March, 1931. They are both off the east coast of Tasmania. At Station 113 *R. annulata* was taken in the otter trawl at 122 metres, and in the Monegasque dredge at 155 to 178 metres. At Station 115 the depth was 128 metres. The former was located at 42° 40 S., 148° 27·5 E., off Maria Island; the latter at 41° 03 S., 148° 42 E. off the north-east corner of Tasmania, near Eddystone Point and not far from the entrance to Banks Strait. Both localities were recorded as having a sea floor consisting of calcareous sand with abundant polyzoa.

The material collected by the Australasian Antarctic Expedition consists of a minute piece of a creeping stem with a tube attached, and of some small fragments of bivalve shell and calcareous polyzoa with remains of the stolon and dark brown pectocaulus present. The shell fragment was tunnelled by a boring sponge. Attached to the stolons were a few tubes (peristomes) which were empty, or contained calcareous debris, foraminifera and sponge spicules, together with rounded bodies, probably faecal pellets of *Rhabdopleura*. The peristomes arise at right angles from the creeping stem, there being no recumbent portion. They are broken, hence the full length is not known. The wall of the tubes, measured at the peristomial rings, varies between 0·017 and 0·029 mm. (average 0·022) in thickness, while the minimum thickness of the region between the rings varies between 0·005 and 0·012 mm. (average 0·0076). The rings thus project 0·0144 mm. (average) on each side from the inter-ring region. The distance between rings ranges from 0·025 to 0·040; average 0·036 mm., most of them being between 0·037 and 0·040 mm. The tubes thus have a distinctly serrated appearance when viewed in optical section. The diameter of the tube at the peristomial rings varies between 0·170 and 0·180 mm., averaging 0·176, the lumen averaging about 0·132 mm. In the fragments available the number of rings ranged between 10 and 23.

The creeping stolon varies from pale yellow-brown to deep purplish brown and pursues and unbranched course (except for the upright peristomes) in a more or less straight line, quite unlike that figured by Lankester, by Schepotieff and by van der Horst for *R. normani*. It adheres closely to the substratum, but it can be lifted off quite easily, though it breaks readily. Its diameter ranges between 0·135 and 0·240 mm. Attached to each side of it is a mass of unorganised material, pale in colour and similar to that indicated in Harmer's figure (text-fig. 2B) and probably secreted by the animal. It extends for a distance of about 0·07 mm. on each side. The tube is very thin (0·003 mm. in thickness) and its rings project very slightly, 0·002 to 0·01 (average about 0·006 mm.

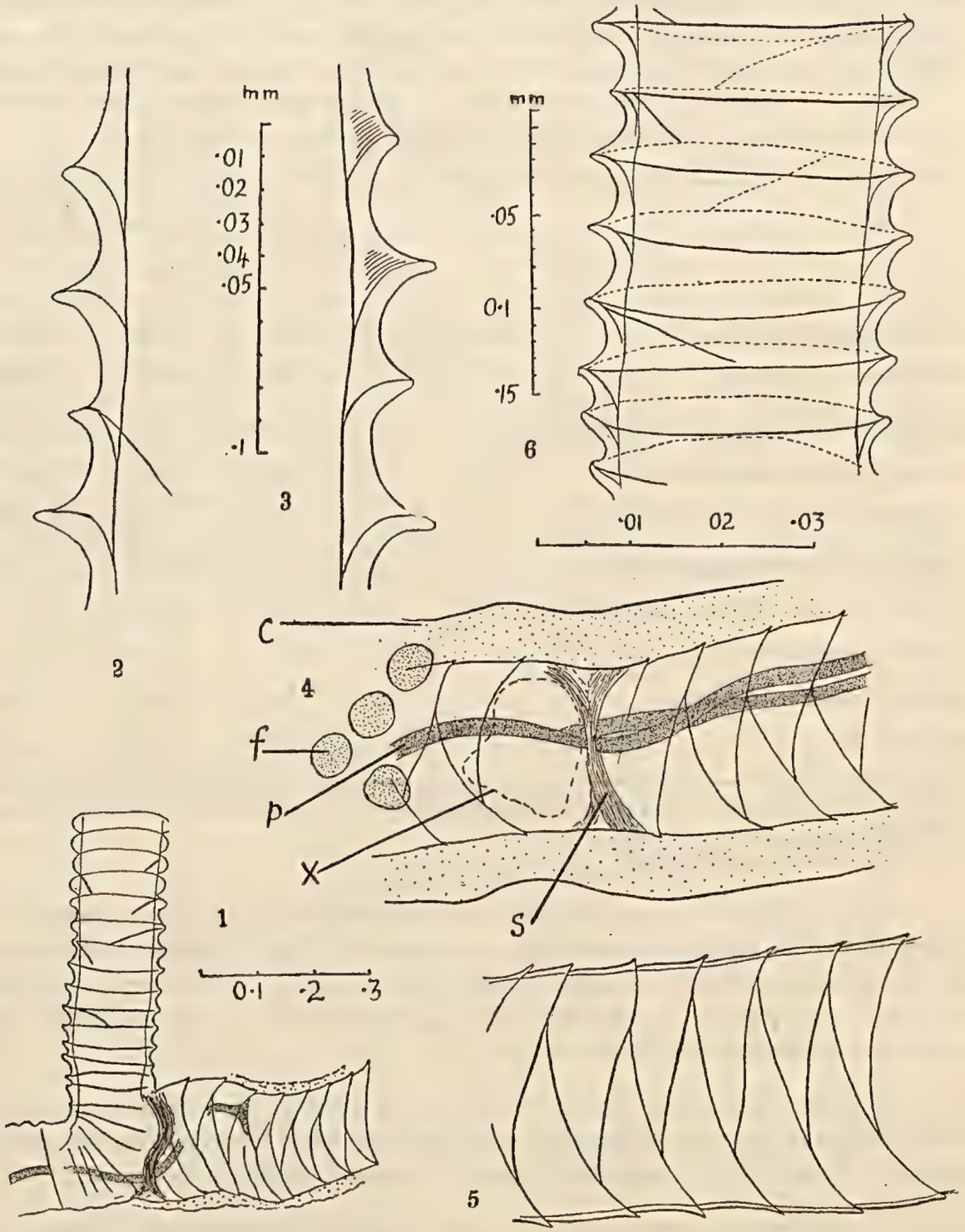

Fig. 1. Peristome and portion of stolon. Figs. 2, 3. Views of edges of peristome in optical sections. Figs. 4, 5. Views of stolon; fig. 4 is drawn to the scale immediately above it; fig. 5 is drawn to the same scale as fig. 6. Fig. 6. Pesistome—*c*, material bordering lateral margins of stolon; *f*, faecal pellets (?) of *Rhabdopleura*; *p*, pectocaulus; *s*, septum; *x*, opening indicating position from which a peristome has been torn out.

and very acutely forwards from the surface. The distance between rings is 0·035 to 0·080 mm. The sutures are quite differently arranged from those of the upright tubes and meet at an angle of about 30° and exhibit a well-marked zig-zag appearance. The very dark brown pectocaulus is an obvious feature in the specimen and has a diameter of 12 to 20 μ. The septum at the junction of the upright and creeping portions of the coenoecium is arranged and shaped like that figured by Norman (1921, fig. 4).

	Siboga specimen (Harmer).	New Zealand (Norman),	Tasmania (Johnston)†.
Number of rings in peristome	13–15	9–47	10–23
Inner diameter of peristome	175–210μ	160–200	132 (average).
Thickness of wall of peristome at middle of a tube ring ...	7·5–11·5μ	9–13	5–12
Average distance between rings	50μ*	50	36 (25–40)
Maximum external diameter of ring	200μ*	265	170–180
Maximum thickness of peristomial wall	25μ*	30–60	17–29
Projection of peristomial rings from inner wall of tube	25–30μ*	30–50	20–25
Diameter of pectocaulus	20–22μ	27–34	12–20
Distance between rings of stolon	44μ*	120	35–80
Diameter of stolon	200μ*	200**	130–240

† All measurements and drawings of the Tasmanian specimens were made whilst the latter were in fluid, without a cover glass.
* Calculated from Harmer's text figure.
** Calculated from Norman's figures.

The validity of the various "species" of *Rhabdopleura* has been questioned by Schepotieff (1906) and Broch (1927) who considered that they all belonged to *R. normani* Allman, though the former described a new species, *R. striata*, from the coast of Ceylon in 1909. As Bergersen and Broch's recent monograph (1932) is not accessible, their view on this question is not known to me.

Harmer and Norman considered that there were several species, though the latter compared especially *R. normani* and *R. annulata*, while Harmer recognised that his fragments from the East Indies differed from *R. normani*, which he also figured.

It may be noted that peristomes of the Tasmanian *R. annulata* when mounted in lactophenol under a cover glass changed their form under the light pressure, losing their markedly serrated margin and becoming very similar to *R. normani*, as figured by Harmer (1905) and Norman (1921). The zooid of *R. annulata* has not been described, but in view of the marked difference in the branching of *R. normani* and in the relative length of that portion of the recumbent stem which is continuous with the upright tube and is separated

from the rest of the stolon by a septum in that species, as figured by Lankester (1884, pl. 37, 39) and Ridewood (1907, 13), there seems to be little doubt that the two are quite distinct. The Siboga specimens, as figured by Harmer, may belong to *R. annulata*. Broch's unfigured account does not allow comparison of the Antarctic material with either species.

The most northerly record of the genus is that for *R. normani* found amongst polyzoa from West Greenland by Norman (1903, 101; footnote). The most southerly point is Gauss Station, 66° 2 S., 89° 38 E. in 350 metres at a temperature —1·84° C. and an average salinity 34·3 parts per thousand. The locality lies a little to the north of the Antarctic Circle and to the westward of Drygalski Island, off Kaiser Wilhelm Land. This material consisted of two detached fragments without zooids and was identified by Broch (1927, 468) as *R. normani*, this investigator agreeing with Schepotieff's view (1906) that there was only one species belonging to the genus. The next southerly record is that reported by Fowler (1904) who recognised *R. normani* amongst the Challenger material from Tristan d'Acunha (38° S., 12° W.) in the South Atlantic, though Harmer (1905, 128) expressed a doubt as to the correctness of the identification. Norman (1921, 98) re-examined the specimens and tentatively assigned them to that species. The newly recorded Tasmanian localities (for *R. annulata*) lie further to the south than Tristan d'Acunha.

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UNIVERSITY OF MONTPELLIER.

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CONTENTS.

	PAGE.
Introduction	5
Diplosoma gelatinosum M-Edw.	6
Sycozoa quoyi Herdman	6
Distaplia cylindrica Lesson	7
Oxycorinia mawsoni n. sp.	7
Sigillina caerulea Herdman	8
Polyclinum clava Herdman	8
Polyclinum sundaicum (Sluiter)	9
Macroclinum stewartense Michaelsen	9
Macroclinum hypurgon Michaelsen	9
Macroclinum flavum (Herdman)	9
Amaroucium circumvolutum (Sluiter)	10
Amaroucium ordinatum var. *herdmani* var. nov.	11
Amaroucium aurorae n. sp.	11
Amaroucium loricatum n. sp.	12

ASCIDIAE COMPOSITAE.

(*Polycitoridae, Didemnidae, Polyclinidae.*)

Par les Docteurs Hervé Harant et Paulette Vernières (Faculté de Médecine de Montpellier).

(Plate XIV.)

INTRODUCTION.

La collection de Tuniciers récoltés au cours de l'expédition antarctique australienne sur le S.Y. " Aurora " comprenant au dire de Herdman environ 360 individus d'ascidies simples ou composées a déja fait l'objet d'un intéressant mémoire du savant ascidiologue anglais. Herdman en effet, dans une brochure de 33 pages soigneusement illustrée de 6 planches, a décrit en 1923 les 22 espèces d'ascidies simples dont 5 nouvelles que renfermait la collection de Sir Douglas Mawson. Ce savant professeur nous a fait l'honneur de nous communiquer la collection dont Herdman n'avait pu terminer l'étude, la mort étant venu trop tot le ravir à la science. Les quelques bocaux qu'Herdman n'avait pas déterminés renferment exclusivement des Ascidies composées au sens de l'auteur anglais. Ces mots demandent quelque lignes d'explication. Tous les ascidiologues contemporains sont actuellement d'accord pour adopter une classification des Ascidies en Ordres définis par la morphologie branchiale; la terminologie de ces dénominations varie mais le principe reste acquis depuis les travaux immortels du savant francais Lahille. Pour notre part revenant résolument à la classification proposée par ce zoologiste nous avons adopté dans tous nos travaux les trois ordres suivants : Stolidobranches; Aplousobranches; Phlébobranches; réservant quelques genres incertae sedis qui présentent des caractéres intermédiaries entre diverses familles et parfois entre les trois ordres ci dessus énumérés. (Voir à ce sujet Harant, 1931.) En définitive la division des Ascidies en Simples et Composées n'a plus aujurd'hui qu'un intérét historique auquel Herdman était resté fidèle. Il est facile d'indiquer l'équivalence des deux classifications. Les trois familles des Polycitoridae (alias Clavelinidés ou Distomidés), des Didemnidae et des Polyclinidae ne renferment incontestablement que des ascidies coloniales sociales ou composées suivant le mode synascidien. Il est donc facile de traiter séparément un chapitre ayant trait aux animaux de ces trois ordres avec la mention Ascidies composées ou Synascidies. Mais il fut ajouter que Herdman faisait aussi rentrer dans les Ascidies composées quelques formes appartenant avec certitude à l'ordre des Stolidobranches et en particulier Les Botryllidés et quelques Styelidae coloniales ou Polystyelinae. Il incorporait aussi dans ce groupement artificiel quelques Phlebobranche Diazonidae et

Perophoridae. C'est donc à toute un ensemble de familles dispar rates que nous aurions eu à faire pour compléter l'ouvre de Herdman qui s'est limité aux ascidies simples de l'expédition antarctique. En fait l'harmonie de notre classification ne saurait être troublée puisque seules des ascidies de l'ordre des aplousobranches sont représentées dans les ascidies composées de la collection qui nous á été confiée. Disons tout de suite que le nombre des individus et des espéces est infinement moins élevé que celui des ascidies simples de la même collection. Nous remercions bien vivement Sir Douglas Mawson de l'honneur qu'il nous a fait et de la confiance qu'il nous a témoignée non seulement en nous adressant les quelques synascidies de son expédition mais encore en nous communiquant la collection d'ascidies simples étudiées par Herdman et dont le matériel nous a servi de termes de comparaison dans divers travaux antérieurs.

Nous dédions ce bref opuscule à la mémoire de l'éminent ascidiologue du Challenger, dont les beaux travaux ne sont continués ici que par un court appendice.

I. FAMILLE DES DIDEMNIDÈS.

Diplosoma gelatinosum *M. Edw.*

Station.—Commonwealth Bay le 21 décembre, 1913; 56–60 fathoms.

Un grand cormus agglutinant fortement le sable. Les dimensions générales de la colonie difficiles à apprécier étant données la fragmentation du spécimen conservé, paraissaient atteindre 15 cm. de coté. La consistance dans l'alcool est spongieuse; la surface du cormus grise es facilement détachable de la tunique commune. Les systèmes sont irréguliers et les cloaques communs sont épars. Sur une coupe verticale de la colonie les ascidiozoides sont " nichés " dans une logettes spéciale de la tunique commun. Les dimensions excédent celles des ascidiozoides de l'espèce type varient de 2 à 3 mm.; le thorax et l'abdomen ayant des longueurs sensiblement égales. L'épaisseur totale du cormus varie de 5 à 8 mm.

Les modalités de structure de la morphologie externe et des dimensions des zoides nous autorisent à considérer cette colonie comme une forme géographique: forma *australiensis*.

II. FAMILLE DES POLYCITORIDÈS.

Sycozoa quoyi (*Herdman*).

= *Collela quoyi* Herdman.

Station.—Ile Macquarie.

Le genre *Sycozoa* récemment amendé par Michaelsen pourrait, en quelque manière, être considéré comme un sous-genre de *Holozoa*. Nous avons examiné une vingtaine de colonies présentant les caractères suivant: la portion de la tunique qui contient les

ascidiozoïdes est le plus souvent aplatie en raquette et les individus y occupent une disposition en éventail. Les dimensions de cette tête du cormus sont de deux centimètres environ, aussi bien en longueur qu'en largeur et le pédoncule est sensiblement égal à la portion du cormus habitée. Tunique blanche opaque en alcool. Ascidiozoïdes rétractés de 2 à 3 millimètres de longueur sur 1 millimètre de largeur. 12 tentacules. Tube digestif simple; endostyle large.

Certaines colonies de *Sycozoa* examinées répondent assez exactement à la forme extérieure décrite par Herdman pour *Collela claviformis*. Nous pensons que cette dernière espèce " incertaine " pour la plupart des auteurs est à mettre en synonymie avec *S. quoyi*.

Cette ascidie a été pechée par le Challenger aux Iles Kerguelen. Les cormus de l'Expédition antarctique australienne portent sans numéro de station la mention Ile Macquarie avec l'indication suivante : " Cast up on beach after storm, W. coast." Par conséquent nous ne pouvons pas être exactement renseignés sur l'habitat de ces colonies arrachées du fond par la tempête et rejetées au rivage. (Fig. 1.)

Distaplia cylindrica *Lesson*.

= *Julinia australis* Calman.

Station.—Péchée en surface le 5 février, 1914; absence d'autres indications.

Oxycorinia mawsoni *n.sp.*

Station 8.—66° 8′ S., 94° 17′ E., 27 janvier, 1914; 120 fathoms.

(Figs. 3 et 4.) Les colonies sont constituées soit par de petites massues isolées de 4 à 6 cm. de hauteur dont la tête seulement contient les thorax et abdomens des ascidiozoïdes; soit par une base azoique grossièrement cylindrique portant des massues de diverses dimensions au nombre de 4 à 6, la tête de ces massues étant comme dans le cas précedent seule habitée. La coloration générale des cormus est gris jaunâtre en alcool, leur base est assez régulièrement ridée; ils n'agglutinent pas le sable. La section d'une massue montre au dessous des logettes superficielles contenant les viscères des ascidiozoïdes de très longs post-abdomen filiformes non-génitalifères et traversant toute la hauteur de la tunique commune. On aperçoit en outre disposés sans ordre dans la région inférieure du cormus des sphérules qui microscopiquement en imposent pour des foyers leucocytaires et mésenchymateux en rapport probablement avec les phénomènes de régression ou de rénovation des ascidiozoïdes.

Les individus ont un thorax court et large (180 à 200 dans les deux dimensions). Les siphons tous deux placés au même niveau sont très irrégulièrement bordés; dans le cas le plus général le siphon buccal est pourvu de six lobes et le siphon cloacal présente une brande marginale faisant quelques larges ondulations. Les lobes buccaux sont régulièrement rectangulaires et leurs bords rectilignes (Fig. 3) ce qui donne au siphon

buccal vu d'en haut une apparence régulièrement circulaire. La branchie comprend de 10 à 12 rangées de trémas petits, souvent à structure embryonnaire, chacun entouré d'un petit nombre de cellules bordantes. Il n'y a pas de plis, ni de sinus longitudinaux, mais les sinus transversaux sont souvent saillants, ces saillies étant plus ou moins régulièrement découpées en languettes. Dans la largeur thoracique la branchie n'occupe guère que les trois quarts tant sont vastes et développés la cavité cloacale et les sacs peribranchiaux. L'oesophage est court, large, fortement contracté. L'estomac dont la longueur habituelle est de un millimètre, possède un raphé médian; ses parois ne possèdent ni saillies, ni aréoles mais une ornamentation méandrique: il est donc fonctionnellement lisse au sens de Harant (1931). Dans certains ascidiozoïdes l'estomac gonflé se distend pour prendre un aspect piriforme. Un post estomac est différencié (Fig. 5).

Les ascidiozoïdes sont hermaphrodites et les gonades sont appliquees contre l'anse intestinale. Dans la majorité des cas on distingue les deux glandes l'une sphérique coiffée par l'autre d'apparence conique. Une très longue tige post-abdominale se termine par des saillies irrégulières en nombre variable.

L'aspect extérieur de la colonie, la structure de la branchie, la dilatation de la cavité cloacale, le long pédicule post-abdominal sont des caractères nets du genre *Oxycorinia* redéfini par Michaelsen en 1930. Mais il faut bien avouer que la définition de ce genre est peu satisfaisante à cause de l'absence d'un critère absolument certain tiré de quelques caractères fixes de la morphologie viscérale. Si on nous permettre l'expression " on sent davantage le genre *Oxycorinia* qu'on ne la prouve." L'espèce que nous venous de décrire est très voisine de *Oxycorinia malayensis* (Sluiter), mais elle s'en distingue par la structure des siphons, de l'estomac et des gonades. Il faut donc à coté de *Oxycorinia thomsoni* auquel Michaelsen a incorporé les espèces *O. centripetens*, *falciformis* et *fascicularis* maintenir *Oxycorinia malayensis* que personne ne semble avoir revu depuis Sluiter et notre nouvelle espèce.

Station 1.—Commonwealth Bay, 22 décembre, 1913; 250 fathoms.

Une dizaine de colonies du même type que précédemment. Certains cormus ont une tête (habitée par les zoïdes) plus dilatée, ce qui leur donne l'apparence de jeunes bolets.

Sigillina (Hyperiodistoma) caerulea *Herdman.*

5 janvier, 1912, 110 fathoms.*

Une colonie comparable à la figure donnée par Herdman pour son *Colella caerulea.* Nous admettons la synonymie de cette espéce avec l'espéce ultérieure de Sluiter. Cette synonymie à été pressentie par Michaelsen qui a incorporé cette espéce à son nouveau sous genre *Hyperiodistoma.*

Rappelons en effet que le genre *Sigillina* est à l'heure actuelle ainsi démembré: sous-genre *Archidistoma*, s.-g. *Eudistoma*, s.-g. *Paessleria*, s.-g. *Hyperiodistoma*, s.-g. *Sigillina* s. str.

*This seems to be an error for 31 January, 1914, Station 12, 64° 32′ S; 97° 20′ E., where a dredging was made in 110 fathoms. (T.H.J.).

III. FAMILLE DES POLYCLINIDÈS.

Polyclinum clava (*Herdman*).

Quelques cormus de la Station 12.—64° 32′ S., 97° 20′ E.; 110 fathoms.

Polyclinum sundaïcum (*Sluiter*).

= *Glossoforum sundaicum* Sluiter.

Une colonie de la Station 7—65° 42′ S., 92° 10′ E.; 60 fathoms.

Les cormus de Sluiter sont de la mer de Timor.

Macroclinum stewartense *Michaelsen* 1924.

Station.—Ile Macquarie, sans indication de date, ni de profondeur.

Cormus composé d'un certain nombre de massues à court pédoncule et à pôle superieur aplati; les massues centrales plus volumineuses et plus riches sont au nombre de 4 à 8; les massues périphériques plus grêles très fortement incrustées de sable sont plus nombreuses et plus riches en ascidiozoïdes. Au total l'aspect extérieur de la colonie rapelle celui des Polyclinidés boréales du genre *Synoicum*. Toutefois les ascidiozoïdes présentent avec une singulière netteté une très vaste estomac, analogue à celui figuré par Michaelsen (loc. cit.) pour *M. stewartense*. Au surplus les caractères de ces ascidies correspondent à ceux décrits par l'auteur allemand pour son espèce des Iles Stewart. Cette station comme celle de l'expédition australienne dénote un habitat nettement antarctique.

Macroclinum hypurgon *Michaelsen*.

Station 12.—31 janvier, 1914; 110 fathoms.

Nous rapportons à ce type une colonie de consistance assez molle constituée par une masse ovoïde dépourvue de zoïdes et surmontée de tubercules sphéroïdaux montrant des systèmes tres réguliers d'ascidiozoïdes peu nombreux. Le type de l'espèce est de la Nouvelle Zélande.

Macroclinum flavum (*Herdman*).

= *Psammaplidium flavum* Herdman.

= *Aplidium flavum* (Sluiter).

Station 9.—27 janvier, 1914; 240 fathoms.

Nous avons retrouvé les caractères de cette espèce dans deux petits cormus grossièrement sphéroïdes de 8 et 12 millimètres de hauteur, spoeux, fortement agglutinant, les particules sableuses étant assez régulièrement disposées dans la tunique

commune autour des ascidiozoïdes. Ceux-ci, très petits, très contractès, à branchie peu développée ont leur partie antérieure enfermée dans des logettes de la portion la plus externe du cormus qui de ce fait constitue une couche très distincte. Les individus possèdent une languette cloacale longue et simple et un estomac lisse petit et quadrangulaire. Ce sont ces détails qui nous font ranger cette espèce dans le genre *Macroclinum*.

On sait, en effet que Herdman a crée le genre *Psammaplidium* sur le seul fait d'avoir constaté des particules de sable incluses dans la tunique de Polyclinidées australes. Tous les ascidiologues contemporains à la suite de Hartmeyer ont été d'accord pour répartir les espèces de *Psammaplidium* dans les divers genres : *Polyclinum*, *Macroclinum*, *Amaroucium* et *Aplidium*, en se conformant aux caractères anatomiques des ascidiozoïdes invoqués dans la définition de ces genres. Il faut souligner toutefois, superposé à ces caractères génériques le mode très particulier des cormus du type *Psammaplidium*. Quand on a l'occasion d'observer des cormus de ce type on se rend compte que l'inclusion de particules sableuses dans la tunique commune résulte d'un processus physiologique très different de l'agglutination banale qu'il est si facile de constater sur divers cormus de synascidies : il s'agit, en effet, chez *Psammaplidium* non plus d'une agglutination superficielle comparable à celle qu'on obtiendrait en enfonçant dans le sable un objet collant, mais d'une véritable incorporation dirigée au cours de la cormogenèse et probablement de précipitation éléctive au voisinage des ascidiozoïdes. Tout se passe, en definitive comme si la colonie se composait un squelette spiculaire aux dépens des débris environnants. C'est là, pour diverses Polyclinidées, un caractère hautement spécifique, un mode physiologique en tous points comparable dans nos conceptions systèmatiques à l'isolement de systèmes qui se rencontre également dans divers genres et que l'un de nous a défini " mode Circinalium."

AMAROUCIUM CIRCUMVOLUTUM (*Sluiter*).

= *Psammaplidium circumvolutum* Sluiter.

= *Amaroucium circumvolutum* Michaelsen 1924.

Station 1.—Commonwealth Bay, 22 décembre, 1913; 350 fathoms.

Nous rapportons à cette espèce une colonie aplatie de cinq centimètres de longueur sur deux de largeur, épaisse de cinq à dix millimètres, de couleur gris sable, piqueté de noir et de consistance spongieuse et sableuse; elle était fixée sur des Algues. On ne voit pas de systèmes et les ascidiozoïdes sont disposés sans ordre et souvent parallèlement à la surface. La tunique commune est incrustée de particules sableuses sur le mode *Psammaplidium* et se rapproche du type de l'espèce. Les ascidiozoïdes présentent une languette cloacale trilobée, les trois lobes étant égaux dans la majorité des cas. L'estomac porte six cannalures très saillantes en forme d'ailettes (Fig. 6); le post-abdomen est très court. Notons que cette ascidie a été déjà récoltée en Nouvelle-Zélande et aux Iles Chatham.

AMAROUCIUM ORDINATUM (*Herdman*), var. HERDMANI, *nov.var.*

Herdman a décrit en 1913 une Polyclinidée du type *Psammaplidium* dont la diagnose ne présente pas de caractères bien particuliers sinon la constatation d'un estomac présentant des cannelures en ellipses très allongées dessinées par l'auteur. Nous rapportons à cette espéce deux colonies de la station 1, 358 fathoms. Ces cormus sont un peu différentes de ceux du type de l'espèce gris verdatres en alcool de consistance spongieuse mais résistante et agglutinant le sable en pleine tunique commune bien que la surface paroi.

AMAROUCIUM AURORAE *n.sp.*

Station 12, 64° 32′ S., 97° 20′ E.—31 janvier, 1914; 110 fathoms.

Le cormus grossièrement sphéroïde, tuberculeux est dépourvu de zoïdes à sa base. Il est nu, lisse, de consistance spongieuse. Il a cinq centimètres de diamètre et d'épaisseur. Il est divisé profondément en lobes, l'ensemble ayant en définitive l'aspect de massues tuberculeuses incomplètement soudées entre elles. La coloration en alcool est grise. Les ascidiozoïdes sont parfaitement visibles à travers la tunique commune et ils sont souvent ordonnés en systèmes elliptiques allongés du type *Botrylloides*. La tunique commune facilement attaquable par le couteau présente une structure alvéolaire spongieuse. Par contre la pellicule superficielle de la colonie est particulièrement résistante, difficile à détacher et quand on la déchire on emporte avec elle la portion, antérieure des ascidoizoïdes (thorax + abdomen) contractés dans des logettes superficielles de la tunique commune. Les post-abdomen plongent au contraire dans la profondeur du cormus.

Les caractères spécifiques des ascidiozoïdes ont les suivants. Une vaste cavité cloacale dilatée en chambre incubatrice est pourvue d'un grand orifice ovale et non lobé surmonté d'une très courte languette parfois légèrement incisée à son sommet (Fig. 7). Le tube digestif est particulièrement caractèristique : l'oesophage est pourvu de quatre à six épaississements longitudinaux depuis la bouche oesophagienne jusqu'à l'estomac. Celui-ci est pourvu de six à huit cannelures parfois interrompues (Fig. 8). La plupart du temps un post-estomac ovoïde à paroi épaisse marque la fin de la portion descendante du tube digestif. L'intestin ascendant et le rectum souvent parcourus de sillons et de plis sont toujours très dilatés.

Adjoutons que le siphon buccal est six-lobé, la branchie pourvue de quinze à vingt rangées de trémas et dépourvue de languettes et de sinus.

Cette intéressante ascidie est bien un *Amaroucium* incontestable, mais elle mérite d'être placée à la limite du genre, au voisinage du genre *Aplidium* à cause de la morphologie très particulière de l'orifice cloacal paraisse lisse. Leur forme et leurs dimensions rappelle celle d'un jeune bolet non encore dressé sur son pied.

Les ascidiozoides sont particulièrement remarquables à cause de leur languette cloacale très volumineuse et très trapue nettement dentée à son extrémité. Les cannelures de l'estomac sont semblables à celles de l'espèce type.

Amaroucium loricatum *n.sp.*

Station 1.—Commonwealth Bay, 22 décembre, 1913; 350 fathoms.

Le cormus que nous décrivons a la forme d'un volumineux tubercule d'orchidée : il est constitué en effet par deux masses ovoides juxtaposées soudées par une large partie de leur surface de contract (Fig. 9). Les systèmes sont très irréguliers; la consistance de la tunique commune dure résistante surtout a la base qui est fibreuse et dépourvue d'ascidiozoides. Les dimensions des deux masses sont de trois centimètres de hauteur sur un centimètre d'épaisseur. La coloration est gris-brunête en alcool; la surface est lisse et la pellicule externe du cormus est très résistante.

Les ascidoizoïdes présentent les caractères spécifiques suivants. Ils sont très allongés et présentent un étranglement caractèristique entre le thorax et l'abdomen. L'orifice cloacal est très dilaté, circulaire non-lobé et pourvu dorsalement d'une longue et mince languette présentant à sa base deux petits lobes triangulaires (Fig. 10). La branchie de la plupart des ascidiozoïdes est bourrée de particules minérales donnant l'impression d'une véritable cuirasse.

Nous notons en outre les autres caractères classiques du genre *Amaroucium* : siphon buccal 6-lobé; branchie pourvue de 10 à 15 rangées de trémas; estomac pourvu de 15 à 20 cannalures toutes semblables faiblement et également saillantes sur toute la hauteur; post-estomac globuleux à paroi épaisse situé à l'extrémité de la portion ascendante du tube digestif; post-abdomen génitalifère non étranglé.

Les quelques remarques qui précèdent ont la valeur intrinsèque des faites qui sont rapportés. Considérant que notre court rapport n'est qu'un appendice et un complément de celui de Herdman, nous nous abstiendrons de considérations générales concernant les animaux que nous avons déterminés.

Notons seulement la grande abondance de colonies synascidiennes dans l'Antarctique, le nombre des cormus récoltés se répartissant d'ailleurs en un petit nombre d'espèces. Nous avons toutefois ajouté aux divers catalogues dressés par Herdman, Hartmeyer, Michaelsen et par nous-même (Expédition de l'Endeavour), trois espèces nouvelles: une Polycitoridée, *Oxycorinia mawsoni*; et deux Polyclinidées du genre *Amaroucium*, *A. aurorae* et *A. loricatum*. Il faut noter en outre l'exhubérance des colonies de Polyclinides, le gigantisme fréquent des ascidiozoïdes et l'abondance des colonies bâties sur le mode *Psammaplidium*.

Nous renvoyons pour les indications bibliographiques au récent travail de Michaelsen (Fauna S.-W. Australien) et à notre rapport sur les Tuniciers récoltés au cours des croisières de l'Endeavour.

Légende des Figures.

Fig. 1. *Sycozoa quoyi* (Herdman).

2. *Oxycorinia mawsoni* n.sp.

3. *Oxycorinia mawsoni*—région siphonale.

4. *Oxycorinia mawsoni*—une colonie.

5. *Oxycorinia mawsoni*—estomac.

6. *Amaroucium circumvolutum* (Sluiter)—estomac.

7. *Amaroucium aurorae* n.sp.—orifice cloacal.

8. *Amaroucium aurorae* n.sp.—tube digestif.

9. *Amaroucium loricatum* n.sp.

10. *Amaroucium loricatum* n.sp.—à gauche un ascidiozoïde; à droite détail de l'orifice cloacal.

[1 plate.]

Sydney: David Harold Paisley, Government Printer—1938.

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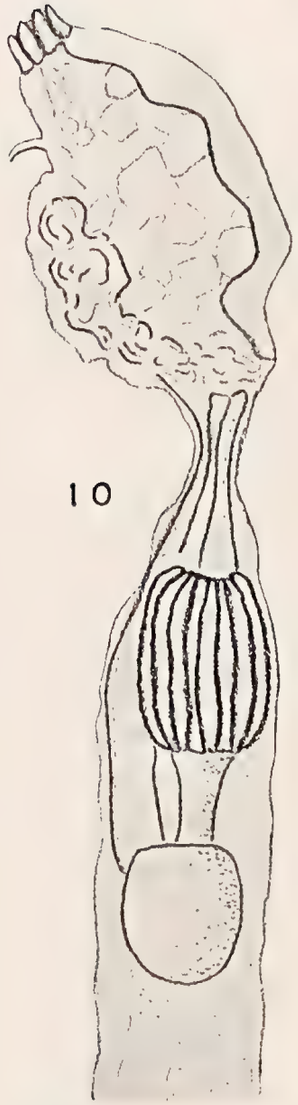
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